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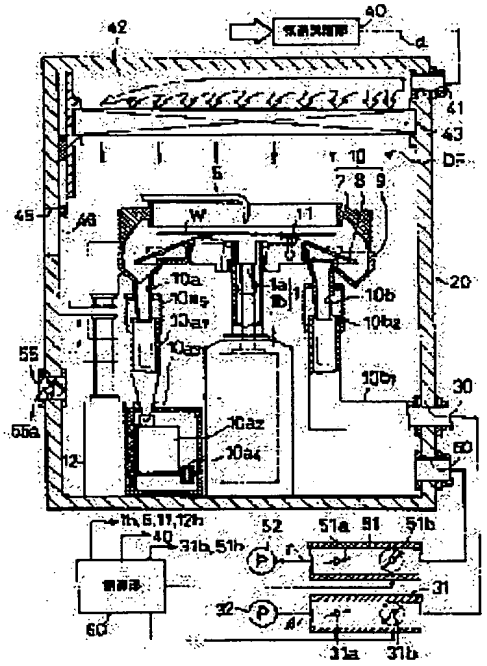
(54) ROTARY WAFER PROCESSING APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To remove mist and odors leaking from a scatter preventive cup to prevent the contamination of wafers both inside and outside a wafer processing apparatus, while taking measures for safety and hygiene.
SOLUTION: A rotary wafer processing apparatus comprises a rotational drive 1 for rotating a wafer W; a nozzle 5 for emitting liquid photoresist; a cup 10 that surrounds the wafer W to prevent photoresist from scattering; and a housing 20 that encloses all the foregoing members, allows a downflow DF within it and includes an exhaust 30 for discharging the cup 10. The housing 20 is provided with another exhaust 50 for discharging the downflow DF, and the exhaust 50 is communicating with an automatic damper 51b for exhaust control.



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CLAIMS

[Claim(s)]
[Claim 1] The revolution driving means which holds a substrate and carries out revolution actuation A processing liquid supply means to supply processing liquid to said substrate The outer container which is having the exhaust port in a cup which consists of a bonnet and the upper part possible [a free passage of the air current (downflow) which goes to a lower part] in the scattering prevention cup which encloses the perimeter of said substrate and prevents scattering of processing liquid, said revolution driving means, said processing liquid supply means, and said scattering prevention cup, and exhausts the inside of said scattering prevention cup formed It is the rotating type substrate processor equipped with the above, and said outer container is characterized by forming the exhaust port outside a cup which exhausts the downflow around said scattering prevention cup.
[Claim 2] The rotating type substrate processor characterized by making free passage connection of an exhaust air flow control means to adjust the exhaust air flow rate which lets the exhaust port outside said cup pass in a rotating type substrate processor according to claim 1.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the technique which exhausts Myst which starts the equipment which supplies processing liquid, such as photoresist liquid, a rinse, a developer, and a penetrant remover, and performs predetermined processing to substrates, such as a semiconductor wafer, a glass substrate for photo masks, a glass substrate for liquid crystal displays, and a substrate for optical disks, especially is generated with processing, and an odor.
[0002]
[Description of the Prior Art] As this conventional kind of a rotating type substrate processor, with for example, the revolution actuator which holds the substrate which is the object of processing and does revolution actuation The processing liquid supply nozzle which supplies the photoresist liquid which is processing liquid to the substrate, The scattering prevention cup which encloses the perimeter of a substrate and prevents scattering of photoresist liquid, Said each part is constituted from a bonnet and the upper part possible [a free passage of the air current (downflow) which goes to a lower part], and a rotating type substrate coater (called a spin coater) equipped with the outer container which had the exhaust port in a cup which exhausts the inside of a scattering prevention cup formed is mentioned.
[0003] The configuration of such equipment is explained below with reference to drawing of longitudinal section of drawing 5 showing the important section. A sign 1 is a revolution actuator containing the spin chuck by which revolution actuation is carried out with an electric motor which does revolution actuation of the supported substrate W among drawing. The processing liquid supply nozzle 5 for supplying photoresist liquid to Substrate W is located in the upper part near the center of rotation of Substrate W. The perimeter of Substrate W is enclosed from the scattering prevention cup 10 for preventing scattering of photoresist liquid. Effluent opening 10a for collecting the photoresist liquid which dispersed around, and exhaust-port 10b for exhausting the air current which flows from the upper part and flows down the periphery of Substrate W are formed in the pars basilaris ossis occipitalis of this scattering prevention cup 10. Moreover, the revolution actuator 1, the processing liquid supply nozzle 5, and the scattering prevention cup 10 are covered with the outer container 20 which has the pure air current (a downflow is called hereafter) DF which goes to a lower part from the upper part. This outer container 20 is having the exhaust port 30 in a cup by which free passage connection was made formed in exhaust-port 10b of the scattering prevention cup 10, in order to put and exhaust what photoresist liquid dispersed and became fog-like (Myst is called hereafter), and particle in the air current which flows down the periphery of Substrate W. It connects with the exhaust air pump which is one of the utilities currently installed in the clean room, and the exhaust port 30 in this cup is exhausted by the regular predetermined flow rate.
[0004] The pars basilaris ossis occipitalis of an outer container 20 is constituted by punching plate 20a in which many stomata were formed so that the downflow DF which flows down from the upper part may put the particle which floats to the outer container 20 interior and may be discharged. Moreover, although the perimeter lateral portion of an outer container 20 is enclosed by frame-side-cover 20b, since it is constituted possible [closing motion] mainly for the

maintenance, it has many clearances. Moreover, under the scattering prevention cup 10, it prevents that various kinds of components fall at the pars basilaris ossis occipitalis in the case of a maintenance, or the plate 100 for making it each component part which has an outer container 20 caudad not appear is arranged.
[0005] With the equipment constituted, thus, the photoresist liquid which dispersed around Substrate W by supply of photoresist liquid The odor resulting from Myst which it was collected through effluent opening 10a as a continuous-line arrow head showed all over drawing, and was dispersed and produced around Substrate W, the organic solvent contained in photoresist liquid, or an alkali component As the continuous-line arrow head in the scattering prevention cup 10 shows, it is exhausted from the exhaust port 30 in a cup through exhaust-port 10b.
[0006]
[Problem(s) to be Solved by the Invention] However, in the case of the conventional example which has such a configuration, there are the following problems. A part of Myst mentioned above and odor by namely, the air current generated mainly with revolution actuation of Substrate W and the downflow DF flowing down Reverse creeps up the wall of the scattering prevention cup 10 from exhaust-port 10b to exhaust air like the dotted-line arrow head shown with the sign A in drawing. Since it flows into the equipment exterior through the clearance between frame-side-cover 10b as it begins to leak out of the scattering prevention cup 10 and Downflow DF extrudes, there is a trouble of doing an adverse effect or causing an insurance sanitary problem to other substrates near [this] equipment. especially the adverse effect to the above-mentioned substrate be effect to high sensitivity photoresist coats , such as the so-called chemistry magnification resist , adopt as micro processing of the latest semi-conductor process progress , and after the substrate which had the high sensitivity photoresist coat form have a predetermined pattern specifically expose by exposure processing , when a high sensitivity photoresist coat touch the odor containing an organic solvent or an alkali component , it be that sensibility deteriorate substantially . Moreover, producing a device defect as effect of others, when Myst and particle adhere to a substrate is mentioned.
[0007] Moreover, although it is in the joint of effluent opening 10a and exhaust-port 10b if the clearance is prepared in consideration of the workability at the time of detaching and attaching in order to mainly wash the scattering prevention cup 10 and bellows-like covering attaches in these clearances, an odor and Myst begin (dotted-line arrow head shown with Sign B all over drawing) to leak from these clearances. It leaks, and as the odor and Myst which came out are too extruded by Downflow DF, they flow into the equipment exterior through the clearance between punching plate 20a or frame-side-cover 20b, and they cause the same problem as the above. Moreover, it leaks, and without flowing into the equipment exterior, it circulates through a part of odor or Myst out of which it came so that it may absorb near the rear-face center of rotation of the substrate W which revolution actuation is carried out and serves as negative pressure, and it adheres to the rear face and front face of Substrate W under processing. The problem of this polluting the substrate W under processing and causing a device defect is also produced.
[0008] In addition, although increasing the exhaust air flow rate of the exhaust port 30 in a cup is easily considered in order to prevent leakage of above-mentioned Myst or an odor, this cannot be performed for the following reasons. Namely, although the photoresist liquid supplied to Substrate W is formed in the coat of predetermined thickness of a high-speed revolution If the exhaust air flow rate of exhaust-port 10b in the scattering prevention cup 10 is made [many] in that case The flow rate of the air current which flows down the periphery of Substrate W according to the air current produced with this exhaust air increases, and a difference arises in the thickness of the increase of the volatilization rate of an organic solvent or an alkali component consequently near the core of Substrate W, and the periphery section which are contained in photoresist liquid. Therefore, with the latest equipment, there is an inclination which weakens the exhaust air flow rate in the scattering prevention cup 10. Consequently, it is actual that the problem resulting from leakage of a Myst and an odor (signs A and B in drawing) which were mentioned above has arisen notably.
[0009] This invention is made in view of such a situation, and it aims at offering the rotating type

substrate processor which can prevent the substrate contamination inside equipment, and substrate contamination of the equipment exterior while it can avoid an insurance sanitary problem by exhausting Myst and the odor which were revealed out of the scattering prevention cup.

[0010]

[Means for Solving the Problem] This invention takes the following configurations, in order to attain such an object. Namely, a rotating type substrate processor according to claim 1 The revolution driving means which holds a substrate and carries out revolution actuation, and a processing liquid supply means to supply processing liquid to said substrate, The scattering prevention cup which encloses the perimeter of said substrate and prevents scattering of processing liquid, The outer container which is having the exhaust port in a cup which consists of a bonnet and the upper part possible [a free passage of the air current (downflow) which goes to a lower part] in said revolution driving means, said processing liquid supply means, and said scattering prevention cup, and exhausts the inside of said scattering prevention cup formed, In a preparation ******** substrate processor, said outer container is characterized by forming the exhaust port outside a cup which exhausts the downflow around said scattering prevention cup.

[0011] Moreover, a rotating type substrate processor according to claim 2 is characterized by making free passage connection of an exhaust air flow control means to adjust the exhaust air flow rate which lets the exhaust port outside said cup pass.

[0012]

[Function] The operation of invention according to claim 1 is as follows. If processing liquid is supplied through a processing liquid supply means to the substrate which is rotating by the revolution driving means, processing liquid will disperse around a substrate. When processing liquid collides with the wall of a scattering prevention cup, while Myst arises and floating in a cup at this time, that component, for example, an organic solvent and an alkali component, serves as an odor, and it piles up in a cup. Myst which floats or piles up in a cup, and an odor are discharged through the exhaust port in a cup formed in the outer container. Although it reveals to the exterior of a scattering prevention cup, ********** Myst, such as a joint, and the odor of Myst which was not discharged, an odor, or piping flow down the inside of an outer container by the downflow with the particle which floats the inside of an outer container, and are exhausted through the exhaust port outside a cup which exhausts the perimeter of a scattering prevention cup. Therefore, since Myst, the internal odor, and internal particle of an outer container are altogether exhausted through the exhaust port in a cup, or the exhaust port outside a cup, while they can prevent those circulation inside equipment, they can be prevented from revealing them out of an outer container.

[0013] Moreover, the operation of invention according to claim 2 is as follows. Namely, although Myst which piles up in a scattering prevention cup, an odor, and particle are exhausted through the exhaust port in a cup with the downflow of an outer container and what leaked and came out of the cup is exhausted from the exhaust port outside a cup When there are too many exhaust air flow rates of the exhaust port outside a cup, Myst, an odor, and particle will flow backwards and suck out of the inside of a cup, and when there are too few exhaust air flow rates of the exhaust port outside a cup, Myst which leaked and came out out of the cup will pile up in an outer container. Then, Myst which leaked and came out out of the cup can be adjusted to the exhaust air flow rate which can be exhausted certainly, without Myst etc. piling up in an outer container, without sucking out Myst in a cup etc. based on the relation between the flow rate of the downflow of an outer container, and the exhaust air flow rate of the exhaust port in a cup by adjusting the exhaust air flow rate of the exhaust port outside a cup through an exhaust air flow control means.

[0014]

[Embodiment of the Invention] Hereafter, one example of this invention is explained with reference to a drawing. Drawing 1 is drawing of longitudinal section showing the outline configuration of the rotating type substrate coater which is an example of the rotating type substrate processor of this invention.

[0015] Sign 1a is a spin chuck which supports almost horizontally the substrate W (for example, semi-conductor wafer) which is the object of processing among drawing. Interlocking connection of this spin-chuck 1a is carried out through the revolving shaft in that pars basilaris ossis occipitalis at electric motor 1b. Electric motor 1b is in the condition contained by housing, and is being fixed to the pars basilaris ossis occipitalis of the outer container mentioned later. Such spin-chuck 1a and electric motor 1b constitute the revolution actuator 1 equivalent to the revolution driving means in this invention.
[0016] The processing liquid supply nozzle 5 for supplying the photoresist liquid which is processing liquid is arranged, and it is prepared above spin-chuck 1a so that the point turned caudad may be located near a center of rotation. The cantilevered suspension of the splash of that end face section of this processing liquid supply nozzle 5 is made free by the splash support device which is not illustrated, and it is constituted possible [rise and fall] by the elevator style which is not illustrated in each location while that point is moved covering the position in readiness from which it separated from the upper part of Substrate W, and the illustrated regurgitation location. In addition, the processing liquid supply nozzle 5 is equivalent to the processing liquid supply means in this invention.
[0017] The perimeter of Substrate W is enclosed from the scattering prevention cup 10 for preventing that photoresist liquid disperses. The scattering prevention cup 10 consists of a cup 7 when it has the inclined plane to which it shows caudad the photoresist liquid which disperses around from opening for conveying Substrate W, and the periphery section of Substrate W, a straightening vane 8 of the plane view circle configuration for rectifying the air current flowing down, and a bottom cup 9 for collecting effluents. The straightening vane 8 is inserted in the inner circumference section of the bottom cup 9, and the peripheral face of the soffit is inserted in the top cup 7 by the inner skin of the bottom cup 9. The bottom cup 9 has a ring-like effluent zone at the pars basilaris ossis occipitalis, and is having effluent opening 10a for collecting the photoresist liquid which dispersed in the three places (only one place is shown by a diagram) formed. Moreover, inside the effluent zone, the exhaust air zone covered with the straightening vane 8 is formed, and exhaust-port 10b for exhausting the air current (Myst, and particle and an odor being included) which flows down the periphery of Substrate W to one place is formed. Moreover, in order to carry out washing clearance of Myst adhering to the photoresist liquid which turned to the periphery section rear face of Substrate W, or a rear face etc., the back-side-rinse nozzle 11 for turning and supplying a rinse to the rear-face periphery section of Substrate W is laid under the center-of-rotation side of a straightening vane 8. Interlocking connection of the lateral surface of the bottom cup 9 is carried out at the rod of an air cylinder 12, and the scattering prevention cup 10 goes up and down to the revolution actuator 1 by making the rod of an air cylinder 12 expand and contract. In addition, you may make it make it go up and down the revolution actuator 1 to a cup 10 by considering the scattering prevention cup 10 as immobilization. Moreover, the back-side-rinse nozzle 11 is equivalent to the processing liquid supply means in this invention like the processing liquid supply nozzle 5 mentioned above.
[0018] Effluent opening 10a is the effluent piping ten a1. Free passage connection is made and it is the effluent piping ten a1. The soffit section is a drain tank ten a2. It is inserted. The photoresist liquid which flowed into effluent opening 10a is the effluent piping ten a1. It passes and is a drain tank ten a2. It is collected. Drain tank ten a2 Drain box ten a3 It is covered and is this drain box ten a3. Exhaust hole ten a4 for exhausting the odor produced from the collected photoresist liquid in the lower part It is formed. Exhaust hole ten a4 An exhaust air pump which is mentioned later is open for free passage (graphic display abbreviation). In addition, although desorption of the scattering prevention cup 10 is carried out for the objects, such as the washing, in consideration of the workability in that case, effluent opening 10a is loosely inserted in the effluent piping ten a1, and the clearance exists in these joints. In this clearance part, it is the bellows-like covering ten a5. It is attached and they are effluent opening 10a and the effluent piping ten a1. It is constituted so that the odor leakage produced from the photoresist liquid adhering to a wall may be controlled.
[0019] Exhaust-port 10b is an exhaust pipe arrangement ten b1. Free passage connection is made. The exhaust pipe arrangement ten b1 is opened for free passage by the exhaust port 30 in

a cup formed in one side face of an outer container 20. Free passage connection of the exhaust port 30 in a cup is made through piping 31 at the exhaust air pump 32 which is one of the utilities of a clean room. In addition, exhaust-port 10b and an exhaust pipe arrangement ten b1 It is the bellows-like covering ten b2 by the reason mentioned above at the joint. It is attached. Two dampers are formed in piping 31 in serial. One of these is manual damper 31a which adjusts an opening with hand control and adjusts a flow rate, and another side is automatic damper 31b which can adjust an opening according to the signal from the outside. In addition, one manual damper 31a is beforehand set up so that an indispensable exhaust air flow rate can be obtained, and it is constituted so that an exhaust air flow rate becomes fixed by automatic damper 31b according to fluctuation of the exhaust air flow rate of the exhaust air pump 32 and it may be controlled.

[0020] Each configuration section mentioned above is blockaded with the outer container 20. That is, the punching board is not used for the pars basilaris ossis occipitalis as the conventional example was suited. Moreover, although covering which is not illustrated and in which the closing motion for a maintenance is free is attached in a lateral portion, the clearance is closed by the sealant etc. so that it may decrease as much as possible. furthermore, the air current DF which flows down from the upper part so that it may mention later -- efficient -- resistance -- in order to send caudad few, in the conventional example, the plate 100 (refer to drawing 5) currently arranged near the pars basilaris ossis occipitalis of the scattering prevention cup 10 is removed. The air-current extraction opening 41 which incorporates the air current by which temperature, humidity, air capacity, etc. were adjusted by the air-current controller 40 is formed in the up side face in this outer container 20. The air current is sent into the chamber 42 formed in the headroom in an outer container 20, and is supplied as a pure downflow DF through a filter 43. In addition, the flow rate of this downflow DF is made to call a flow rate alpha for convenience. Moreover, in order to raise the lock out degree of an outer container 20, the conveyance opening 45 for taking out a substrate [finishing / processing] is opened [an unsettled substrate is carried in or] and closed by the shutter 46. That is, interlocking connection of the part by which crookedness formation was carried out at the shape of a character of L of a shutter 46 is carried out at the rod of an air cylinder 12. It drops a shutter 46 and makes the conveyance opening 45 open while it drops the scattering prevention cup 10 to the revolution actuator 1 by shrinking that rod, in case this air cylinder 12 conveys a substrate all over drawing, as the two-dot chain line showed. While raising the scattering prevention cup 10 by expanding the rod, a shutter 46 is raised and the closedown of the conveyance opening 45 is carried out.

[0021] It is the side face of an outer container 20, and the exhaust port 50 outside a cup is formed down the exhaust port 30 in a cup. Free passage connection of the exhaust port 50 outside a cup is made through piping 51 at the exhaust air pump 52 which is one of the utilities of a clean room. Two dampers are arranged in piping 51 in serial, one of these is manual damper 51a which can adjust an opening by hand control, and another side is automatic damper 51b which can adjust an opening according to the signal from the outside. One manual damper 51a is constituted so that it may be controlled to become the setting-out exhaust air flow rate which an exhaust air flow rate mentions later according to a processing state, while it is beforehand set up so that an indispensable exhaust air flow rate can be obtained, and an exhaust air flow rate is uniformly controlled by automatic damper 51b according to fluctuation of the exhaust air flow rate of the exhaust air pump 52. In addition, automatic damper 51b is equivalent to the exhaust air flow control means in this invention. Moreover, the flow rate exhausted from the exhaust port 30 in a cup mentioned above on account of explanation is made into the exhaust air flow rate beta in a cup, and the flow rate exhausted from the exhaust port 50 outside a cup is called the exhaust air-cup outside flow rate gamma.

[0022] The fresh air intake 55 is formed under the conveyance opening 45 of an outer container 20. This fresh air intake 55 permits only the inflow of the open air into an outer container 20, and check valve 55a is arranged so that runoff to the exterior out of an outer container 20 may be forbidden. Although it mentions later for details, this fresh air intake 55 has the function to compensate a part for that air current that ran short so that Myst etc. may flow backwards and

may not be sucked out of a cup 10, when the exhaust air-cup outside flow rate gamma of the exhaust port 50 outside a cup increases more than the difference of the flow rate alpha of Downflow DF, and the exhaust air flow rate beta in a cup of the exhaust port 30 in a cup.
[0023] In addition, the control in connection with spreading processing of the revolving speed control of electric motor 1b of the revolution actuator 1, migration control of the processing liquid supply nozzle 5 and supply control, supply control of the rinse from the back-side-rinse nozzle 11, expanding control of the rod of an air cylinder 12, etc., The downflow control of the air-current controller 40 which adjusts Downflow DF to predetermined temperature, humidity, and a flow rate alpha and which is performed for accumulating, Generalization control is carried out by the control section 60 with exhaust air control of opening control of automatic damper 51b for adjusting opening control of automatic damper 31b for adjusting the exhaust air flow rate beta in a cup, and the exhaust air-cup outside flow rate gamma. In addition, the control section 60 builds in the memory which is not illustrated and performs processing based on the program (called a recipe) which shows the procedure equivalent to the timing diagram mentioned later memorized by this memory. Moreover, the setting-out exhaust air flow Q 1 of the exhaust air-cup outside flow rate gamma mentioned later and Q2 are beforehand set as a recipe. Therefore, according to a recipe, those values can be suitably set up now.
[0024] Next, actuation of the equipment mentioned above is explained with reference to the timing diagram of drawing 2 and drawing 3 , and drawing 4 . In addition, a continuous-line arrow head shows the flow of an air current typically, and when the air current contains Myst, an odor, and particle, the dotted-line arrow head shows drawing 3 and drawing 4 .
[0025] Drawing 2 is referred to. First, a substrate is conveyed in a time amount zero. While shrinking the rod of an air cylinder 12 and specifically dropping the scattering prevention cup 10, the conveyance opening 45 is made to open. The unsettled substrate supported by the conveyance arm which is not illustrated is received, and it is made to lay in spin-chuck 1a in this condition. If the conveyance arm which is not illustrated leaves the conveyance opening 45, while expanding the rod of an air cylinder 12 and raising the scattering prevention cup 12, a shutter 46 is raised and the closedown of the conveyance opening 45 is carried out. An outer container 20 will be blockaded by this. Furthermore, the splash support device and elevator style which are not illustrated are driven, and the processing liquid supply nozzle 5 is moved above near the center of rotation of Substrate W. This condition is in the condition shown in drawing 3 . In addition, in the usual condition, a control section 60 adjusts the opening of automatic damper 51b so that it may become little exhaust air flow Q 1 as compared with the exhaust air-cup outside flow rate gamma within the fixed section to taking out of a processing substrate after the supply interruption of photoresist liquid which is explained below (Q2).
[0026] The relation of each flow rate in this condition is controlled to become control 1, i.e., alpha-beta**Q, so that it may become alpha-beta**gamma. Therefore, as shown in drawing 3 , the downflow DF which flows in the scattering prevention cup 10 passes along exhaust-port 10b and the exhaust port 30 in a cup, and is exhausted with the exhaust air pump 32. On the other hand, the downflow DF which flows down a way outside the scattering prevention cup 10 incorporates the particle generated from an air cylinder 12, electric motor 1b, etc., and is exhausted with the exhaust air pump 52 through the exhaust port 50 outside a cup. Moreover, effluent piping ten a1 Adhering photoresist liquid (it adheres at the time of the substrate processing before this explanation) and an adhering drain box ten a3 The odor produced from the photoresist liquid collected inside flows in with Downflow DF toward the exhaust port 50 outside a cup.
[0027] And a control section 60 is time amount t1. It sets and supply of photoresist liquid is started to Substrate W through the processing liquid supply nozzle 5. Time amount t2 It sets, the revolution actuator 1 is controlled and it is time amount t3. A revolution is started so that the rotational frequency of Substrate W may turn into a rotational frequency R1. By this revolution actuation, the photoresist liquid currently supplied can be opened around Substrate W. time amount t1 from — time amount t3 after predetermined time Setting, a control section 60 suspends supply of photoresist liquid. It is t2 the event of the rotational frequency of Substrate W beginning to rise towards a rotational frequency R1. The odor, Myst, etc. are delayed to some

extent, and it is begun to reveal them, although it sets, the photoresist liquid supplied to the substrate W front face disperses around and it begins to generate Myst and an odor out of the scattering prevention cup 10. Then, time amount t2 In the delayed time amount t3, the opening of automatic damper 51b is enlarged synchronizing with the signal of the supply interruption of photoresist liquid, and the exhaust air-cup outside flow rate gamma is adjusted to the bigger exhaust air flow Q 2 than this from Q1. this time amount t3 from -- the time delay which an exhaust air flow rate increases gradually and is proportional to the volume of the [outer container 20 -- setting --] time amount t4 The exhaust air-cup outside flow rate gamma is set to Q2. The relation of each flow rate in this condition is controlled to become control 1, i.e., alpha-beta<Q, so that it may become alpha-beta<gamma. Therefore, although compensated [come] by absorbing an air current including Myst in the scattering prevention cup 10 etc., if the amount of [which whose exhaust-air-cup outside flow rate gamma=Q 2 increased more than the flow rate which deducted the exhaust air flow rate beta in a cup from the flow rate alpha of Downflow DF, and ran short] flow rate becomes such, Myst which should be exhausted through the exhaust port 30 in a cup will be sucked out besides a cup, and it will do an adverse effect. However, since the open air flows so that a part for a lack flow rate may be compensated from a fresh air intake 55 as shown in drawing 3 , the above adverse effects can be prevented.

[0028] Therefore, so that the wall of the scattering prevention cup 10 top cup 7 may be crept up, or as Myst and the odor which were generated are extruded by Downflow DF, they are revealed out of the scattering prevention cup 10. It is caudad washed away by this Myst and odor that were revealed, and they are exhausted by Downflow DF through the exhaust port 50 outside a cup. Moreover, the particle produced from moving part, such as an air cylinder 12, is put on the open air which flows from Downflow DF and a fresh air intake 55, and is similarly exhausted from the exhaust port 50 outside a cup. the bellows-like covering ten a5 and ten b2 from -- the odor and Myst to reveal are also exhausted certainly, without revealing to the equipment exterior similarly. [moreover,] Therefore, it can prevent that a device defect arises in the substrate W which the air current containing Myst or particle circulates through, and carries out adhesion contamination at the table rear face of Substrate W consequently which is processed with this equipment. Moreover, since an odor, Myst, and particle are not revealed to the equipment exterior, either, while being able to prevent an odor, Myst, etc. touching the substrate in the exterior of this equipment, for example, degrading the sensibility of the high sensitivity photoresist coat [finishing / exposure] of a chemistry magnification resist etc., contamination of the substrate of the equipment exterior can be prevented.

[0029] Thus, while it has been in the condition that the exhaust air-cup outside flow rate gamma was made into flow Q 2, processing to Substrate W is performed as follows.

[0030] Time amount t5 It sets and is time amount t6. A control section 60 controls the revolution actuator 1 so that the rotational frequency of Substrate W turns into a rotational frequency R3 at the event. this rotational frequency R3 -- time amount t7 up to -- the photoresist coat of predetermined thickness is formed in the front face of Substrate W by holding. Also in this engine speed R3, although surplus photoresist liquid disperses and Myst and an odor occur, as it mentioned above, they are exhausted certainly.

[0031] Time amount t7 It sets and is time amount t8. It is made for the rotational frequency of Substrate W to be set to R1. And time amount t9 Or a rinse is supplied from the back-side-rinse nozzle 11 between time amount t10, and washing clearance of unnecessary photoresist liquid and unnecessary Myst adhering to the rear face of Substrate W is carried out. Then, in time amount t11, a rotational frequency is raised so that a rotational frequency may be set to R2 (lower more highly than a rotational frequency R1 than a rotational frequency R3) by time amount t12. By holding revolution actuation at this rotational frequency R2 to time amount t13, swing OFF dries Substrate W for the rinse supplied to the rear face of Substrate W. In addition, as the odor and Myst which are generated in the meantime were also mentioned above, they are certainly exhausted through the exhaust port 50 outside a cup. And it is made to synchronize with the signal and it is begun to return the exhaust air-cup outside flow rate gamma to the original flow Q 1 from flow Q 2, when a revolution stops (time amount t14) while lowering a rotational frequency so that a revolution may stop by time amount t14. That is, it is because

Myst or the odor by the rinse generated by the revolution swing end do not need to decrease, so that they can be certainly exhausted through the exhaust port 30 in a cup at the event (time amount t14), and it is not necessary to exhaust through the exhaust port 50 outside a cup any longer.

[0032] In time amount t14, while beginning to decrease the exhaust air-cup outside flow rate gamma to flow Q 1, the substrate [finishing / processing] W is taken out and a new substrate is carried in. Thus, the processing to one substrate W can be completed and it can process to a substrate one by one by repeating actuation which was mentioned above and performing it after time amount t14. Since it is made to exhaust by limiting the section which Myst etc. reveals rather than always performs the exhaust air from the exhaust port 50 outside a cup as mentioned above, while an insurance sanitary problem which was mentioned above is avoidable, in addition to the effectiveness that the substrate contamination inside equipment and substrate contamination of the equipment exterior can be prevented, the energy which exhaust air, cup outside takes can be saved. Although the utility of a clean room was used as exhaust air pumps 32 and 52 with above example equipment, it is effective especially when the pump of dedication is arranged in this equipment.

[0033] Thus, with the constituted equipment, since an odor, Myst, and particle are not revealed to the equipment exterior, either, an odor, Myst, etc. touch the substrate in the exterior of this equipment, and while being able to prevent degrading the sensibility of a high sensitivity photoresist coat [finishing / exposure], contamination of the substrate of the equipment exterior can be prevented. Therefore, in the process unit equipped with two or more processors, such as a rotating type substrate developer, a substrate thermal treatment equipment, and a substrate aligner, in one, since the rotating type substrate coater constituted in this way can prevent having an adverse effect on other equipments, it is suitable.

[0034] In addition, as for the timing which sets up the timing which changes the exhaust air-cup outside flow rate gamma into flow Q 2 from flow Q 1 just before Myst, an odor, or particle occurs and revealing from a cup 10 etc. as mentioned above, and is returned to flow Q 1 from flow Q 2, it is most desirable to double with the timing [Myst, an odor, or particle] no longer generating. However, you may always set it as the exhaust air flow Q 2 until the processing to all substrates is completed from the event of the processing initiation switch of equipment being pushed by the operator and substrate conveyance being started, at i.e., the event of processing being started, without carrying out adjustable [of for example the exhaust air-cup outside flow rate gamma] when the timing is not in agreement on the relation of the control signal of equipment. Moreover, you may make it always set the exhaust air-cup outside flow rate gamma as flow Q 2 until it is turned off from the condition that the power source of equipment was turned on irrespective of the processing state as mentioned above. Moreover, ON of a power source / automatic damper 51b which is not concerned off, but may always be made to perform exhaust air cup outside also in the condition that a power source is off, and adjusts an exhaust air flow rate in that case is unnecessary.

[0035] in addition , the timing (time amount t3 and t14) of the setting out exhaust air flow Q 1 of the exhaust air - cup outside flow rate gamma , Q2 , and the switch of those be set up for every recipe beforehand memorize by memory , and can set up now a proper flow rate and timing according to the contents of processing (for example , the engine speed which have big effect on generating of Myst , time amount or the class of photoresist liquid to supply , etc.) .

[0036] Moreover, although the above-mentioned example took and explained to the example the rotating type substrate coater which applies photoresist liquid as processing liquid, it is clear to be able to replace with photoresist liquid and for it to be able to apply also to the equipment which applies the polyimide liquid used as an insulator layer or a surface protective coat and SOG (Spin On Glass) liquid.

[0037] Moreover, although the above-mentioned example took and explained the rotating type substrate coater which applies processing liquid to the example, this invention is not limited to this equipment and can be applied to various rotating type substrate processors. For example, it is applicable to a rotating type substrate developer (called a spin developer), a rotating type substrate washing station (called a spin scrubber), etc.

[0038]
[Effect of the Invention] Since Myst, the internal odor, and internal particle of an outer container are altogether exhausted through the exhaust port in a cup, or the exhaust port outside a cup, while they can prevent those circulation inside equipment, they can be prevented from revealing them out of an outer container according to invention according to claim 1 so that clearly from the above explanation. Therefore, while a problem insurance sanitary [resulting from an odor leaking to the equipment exterior] is avoidable, the substrate contamination inside equipment and substrate contamination of the equipment exterior can be prevented.
[0039] Moreover, Myst which leaked and came out out of the cup can be adjusted to the exhaust air flow rate which can be exhausted certainly, without Myst etc. piling up in an outer container, without sucking out Myst in a cup etc. by adjusting the exhaust air flow rate of the exhaust port outside a cup through an exhaust air flow control means according to invention according to claim 2. Therefore, according to the content of processing, an exhaust air flow rate can be adjusted to the optimal exhaust air flow rate.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the technique which exhausts Myst which starts the equipment which supplies processing liquid, such as photoresist liquid, a rinse, a developer, and a penetrant remover, and performs predetermined processing to substrates, such as a semi-conductor wafer, a glass substrate for photo masks, a glass substrate for liquid crystal displays, and a substrate for optical disks, especially is generated with processing, and an odor.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] As this conventional kind of a rotating type substrate processor, with for example, the revolution actuator which holds the substrate which is the object of processing and does revolution actuation The processing liquid supply nozzle which supplies the photoresist liquid which is processing liquid to the substrate, The scattering prevention cup which encloses the perimeter of a substrate and prevents scattering of photoresist liquid, Said each part is constituted from a bonnet and the upper part possible [a free passage of the air current (downflow) which goes to a lower part], and a rotating type substrate coater (called a spin coater) equipped with the outer container which had the exhaust port in a cup which exhausts the inside of a scattering prevention cup formed is mentioned.
[0003] The configuration of such equipment is explained below with reference to drawing of longitudinal section of drawing 5 showing the important section. A sign 1 is a revolution actuator containing the spin chuck by which revolution actuation is carried out with an electric motor which does revolution actuation of the supported substrate W among drawing. The processing liquid supply nozzle 5 for supplying photoresist liquid to Substrate W is located in the upper part near the center of rotation of Substrate W. The perimeter of Substrate W is enclosed from the scattering prevention cup 10 for preventing scattering of photoresist liquid. Effluent opening 10a for collecting the photoresist liquid which dispersed around, and exhaust-port 10b for exhausting the air current which flows from the upper part and flows down the periphery of Substrate W are formed in the pars basilaris ossis occipitalis of this scattering prevention cup 10. Moreover, the revolution actuator 1, the processing liquid supply nozzle 5, and the scattering prevention cup 10 are covered with the outer container 20 which has the pure air current (a downflow is called hereafter) DF which goes to a lower part from the upper part. This outer container 20 is having the exhaust port 30 in a cup by which free passage connection was made formed in exhaust-port 10b of the scattering prevention cup 10, in order to put and exhaust what photoresist liquid dispersed and became fog-like (Myst is called hereafter), and particle in the air current which flows down the periphery of Substrate W. It connects with the exhaust air pump which is one of the utilities currently installed in the clean room, and the exhaust port 30 in this cup is exhausted by the regular predetermined flow rate.
[0004] The pars basilaris ossis occipitalis of an outer container 20 is constituted by punching plate 20a in which many stomata were formed so that the downflow DF which flows down from the upper part may put the particle which floats to the outer container 20 interior and may be discharged. Moreover, although the perimeter lateral portion of an outer container 20 is enclosed by frame-side-cover 20b, since it is constituted possible [closing motion] mainly for the maintenance, it has many clearances. Moreover, under the scattering prevention cup 10, it prevents that various kinds of components fall at the pars basilaris ossis occipitalis in the case of a maintenance, or the plate 100 for making it each component part which has an outer container 20 caudad not appear is arranged.
[0005] With the equipment constituted, thus, the photoresist liquid which dispersed around Substrate W by supply of photoresist liquid The odor resulting from Myst which it was collected through effluent opening 10a as a continuous-line arrow head showed all over drawing, and was dispersed and produced around Substrate W, the organic solvent contained in photoresist liquid,

or an alkali component As the continuous-line arrow head in the scattering prevention cup 10 shows, it is exhausted from the exhaust port 30 in a cup through exhaust-port 10b.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] Since Myst, the internal odor, and internal particle of an outer container are altogether exhausted through the exhaust port in a cup, or the exhaust port outside a cup, while they can prevent those circulation inside equipment, they can be prevented from revealing them out of an outer container according to invention according to claim 1 so that clearly from the above explanation. Therefore, while a problem insurance sanitary [resulting from an odor leaking to the equipment exterior] is avoidable, the substrate contamination inside equipment and substrate contamination of the equipment exterior can be prevented.
[0039] Moreover, Myst which leaked and came out out of the cup can be adjusted to the exhaust air flow rate which can be exhausted certainly, without Myst etc. piling up in an outer container, without sucking out Myst in a cup etc. by adjusting the exhaust air flow rate of the exhaust port outside a cup through an exhaust air flow control means according to invention according to claim 2. Therefore, according to the content of processing, an exhaust air flow rate can be adjusted to the optimal exhaust air flow rate.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the case of the conventional example which has such a configuration, there are the following problems. A part of Myst mentioned above and odor by namely, the air current generated mainly with revolution actuation of Substrate W and the downflow DF flowing down Reverse creeps up the wall of the scattering prevention cup 10 from exhaust-port 10b to exhaust air like the dotted-line arrow head shown with the sign A in drawing. Since it flows into the equipment exterior through the clearance between frame-side-cover 10b as it begins to leak out of the scattering prevention cup 10 and Downflow DF extrudes, there is a trouble of doing an adverse effect or causing an insurance sanitary problem to other substrates near [this] equipment. especially the adverse effect to the above-mentioned substrate be effect to high sensitivity photoresist coats , such as the so-called chemistry magnification resist , adopt as micro processing of the latest semi-conductor process progress , and after the substrate which had the high sensitivity photoresist coat form have a predetermined pattern specifically expose by exposure processing , when a high sensitivity photoresist coat touch the odor containing an organic solvent or an alkali component , it be that sensibility deteriorate substantially . Moreover, producing a device defect as effect of others, when Myst and particle adhere to a substrate is mentioned.
[0007] Moreover, although it is in the joint of effluent opening 10a and exhaust-port 10b if the clearance is prepared in consideration of the workability at the time of detaching and attaching in order to mainly wash the scattering prevention cup 10 and bellows-like covering attaches in these clearances, an odor and Myst begin (dotted-line arrow head shown with Sign B all over drawing) to leak from these clearances. It leaks, and as the odor and Myst which came out are too extruded by Downflow DF, they flow into the equipment exterior through the clearance between punching plate 20a or frame-side-cover 20b, and they cause the same problem as the above. Moreover, it leaks, and without flowing into the equipment exterior, it circulates through a part of odor or Myst out of which it came so that it may absorb near the rear-face center of rotation of the substrate W which revolution actuation is carried out and serves as negative pressure, and it adheres to the rear face and front face of Substrate W under processing. The problem of this polluting the substrate W under processing and causing a device defect is also produced.
[0008] In addition, although increasing the exhaust air flow rate of the exhaust port 30 in a cup is easily considered in order to prevent leakage of above-mentioned Myst or an odor, this cannot be performed for the following reasons. Namely, although the photoresist liquid supplied to Substrate W is formed in the coat of predetermined thickness of a high-speed revolution If the exhaust air flow rate of exhaust-port 10b in the scattering prevention cup 10 is made [many] in that case The flow rate of the air current which flows down the periphery of Substrate W according to the air current produced with this exhaust air increases, and a difference arises in the thickness of the increase of the volatilization rate of an organic solvent or an alkali component consequently near the core of Substrate W, and the periphery section which are contained in photoresist liquid. Therefore, with the latest equipment, there is an inclination which weakens the exhaust air flow rate in the scattering prevention cup 10. Consequently, it is actual that the problem resulting from leakage of a Myst and an odor (signs A and B in drawing) which

were mentioned above has arisen notably.
[0009] This invention is made in view of such a situation, and it aims at offering the rotating type substrate processor which can prevent the substrate contamination inside equipment, and substrate contamination of the equipment exterior while it can avoid an insurance sanitary problem by exhausting Myst and the odor which were revealed out of the scattering prevention cup.

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MEANS

[Means for Solving the Problem] This invention takes the following configurations, in order to attain such an object. Namely, a rotating type substrate processor according to claim 1 The revolution driving means which holds a substrate and carries out revolution actuation, and a processing liquid supply means to supply processing liquid to said substrate, The scattering prevention cup which encloses the perimeter of said substrate and prevents scattering of processing liquid, The outer container which is having the exhaust port in a cup which consists of a bonnet and the upper part possible [a free passage of the air current (downflow) which goes to a lower part] in said revolution driving means, said processing liquid supply means, and said scattering prevention cup, and exhausts the inside of said scattering prevention cup formed, In a preparation ******** substrate processor, said outer container is characterized by forming the exhaust port outside a cup which exhausts the downflow around said scattering prevention cup.
[0011] Moreover, a rotating type substrate processor according to claim 2 is characterized by making free passage connection of an exhaust air flow control means to adjust the exhaust air flow rate which lets the exhaust port outside said cup pass.

[Translation done.]

OPERATION

[Function] The operation of invention according to claim 1 is as follows. If processing liquid is supplied through a processing liquid supply means to the substrate which is rotating by the revolution driving means, processing liquid will disperse around a substrate. When processing liquid collides with the wall of a scattering prevention cup, while Myst arises and floating in a cup at this time, that component, for example, an organic solvent and an alkali component, serves as an odor, and it piles up in a cup. Myst which floats or piles up in a cup, and an odor are discharged through the exhaust port in a cup formed in the outer container. Although it reveals to the exterior of a scattering prevention cup, ********** Myst, such as a joint, and the odor of Myst which was not discharged, an odor, or piping flow down the inside of an outer container by the downflow with the particle which floats the inside of an outer container, and are exhausted through the exhaust port outside a cup which exhausts the perimeter of a scattering prevention cup. Therefore, since Myst, the internal odor, and internal particle of an outer container are altogether exhausted through the exhaust port in a cup, or the exhaust port outside a cup, while they can prevent those circulation inside equipment, they can be prevented from revealing them out of an outer container.
[0013] Moreover, the operation of invention according to claim 2 is as follows. Namely, although Myst which piles up in a scattering prevention cup, an odor, and particle are exhausted through the exhaust port in a cup with the downflow of an outer container and what leaked and came out of the cup is exhausted from the exhaust port outside a cup When there are too many exhaust air flow rates of the exhaust port outside a cup, Myst, an odor, and particle will flow backwards and suck out of the inside of a cup, and when there are too few exhaust air flow rates of the exhaust port outside a cup, Myst which leaked and came out out of the cup will pile up in an outer container. Then, Myst which leaked and came out out of the cup can be adjusted to the exhaust air flow rate which can be exhausted certainly, without Myst etc. piling up in an outer container, without sucking out Myst in a cup etc. based on the relation between the flow rate of the downflow of an outer container, and the exhaust air flow rate of the exhaust port in a cup by adjusting the exhaust air flow rate of the exhaust port outside a cup through an exhaust air flow control means.
[0014]
[Embodiment of the Invention] Hereafter, one example of this invention is explained with reference to a drawing. Drawing 1 is drawing of longitudinal section showing the outline configuration of the rotating type substrate coater which is an example of the rotating type substrate processor of this invention.
[0015] Sign 1a is a spin chuck which supports almost horizontally the substrate W (for example, semi-conductor wafer) which is the object of processing among drawing. Interlocking connection of this spin-chuck 1a is carried out through the revolving shaft in that pars basilaris ossis occipitalis at electric motor 1b. Electric motor 1b is in the condition contained by housing, and is being fixed to the pars basilaris ossis occipitalis of the outer container mentioned later. Such spin-chuck 1a and electric motor 1b constitute the revolution actuator 1 equivalent to the revolution driving means in this invention.
[0016] The processing liquid supply nozzle 5 for supplying the photoresist liquid which is

processing liquid is arranged, and it is prepared above spin-chuck 1a so that the point turned caudad may be located near a center of rotation. The cantilevered suspension of the splash of that end face section of this processing liquid supply nozzle 5 is made free by the splash support device which is not illustrated, and it is constituted possible [rise and fall] by the elevator style which is not illustrated in each location while that point is moved covering the position in readiness from which it separated from the upper part of Substrate W, and the illustrated regurgitation location. In addition, the processing liquid supply nozzle 5 is equivalent to the processing liquid supply means in this invention.

[0017] The perimeter of Substrate W is enclosed from the scattering prevention cup 10 for preventing that photoresist liquid disperses. The scattering prevention cup 10 consists of a cup 7 when it has the inclined plane to which it shows caudad the photoresist liquid which disperses around from opening for conveying Substrate W, and the periphery section of Substrate W, a straightening vane 8 of the plane view circle configuration for rectifying the air current flowing down, and a bottom cup 9 for collecting effluents. The straightening vane 8 is inserted in the inner circumference section of the bottom cup 9, and the peripheral face of the soffit is inserted in the top cup 7 by the inner skin of the bottom cup 9. The bottom cup 9 has a ring-like effluent zone at the pars basilaris ossis occipitalis, and is having effluent opening 10a for collecting the photoresist liquid which dispersed in the three places (only one place is shown by a diagram) formed. Moreover, inside the effluent zone, the exhaust air zone covered with the straightening vane 8 is formed, and exhaust-port 10b for exhausting the air current (Myst, and particle and an odor being included) which flows down the periphery of Substrate W to one place is formed. Moreover, in order to carry out washing clearance of Myst adhering to the photoresist liquid which turned to the periphery section rear face of Substrate W, or a rear face etc., the back-side-rinse nozzle 11 for turning and supplying a rinse to the rear-face periphery section of Substrate W is laid under the center-of-rotation side of a straightening vane 8. Interlocking connection of the lateral surface of the bottom cup 9 is carried out at the rod of an air cylinder 12, and the scattering prevention cup 10 goes up and down to the revolution actuator 1 by making the rod of an air cylinder 12 expand and contract. In addition, you may make it make it go up and down the revolution actuator 1 to a cup 10 by considering the scattering prevention cup 10 as immobilization. Moreover, the back-side-rinse nozzle 11 is equivalent to the processing liquid supply means in this invention like the processing liquid supply nozzle 5 mentioned above.

[0018] Effluent opening 10a is the effluent piping ten a1. Free passage connection is made and it is the effluent piping ten a1. The soffit section is drain-tank 10 a<SUB>2. It is inserted. The photoresist liquid which flowed into effluent opening 10a is the effluent piping ten a1. It passes and is a drain tank ten a2. It is collected. Drain tank ten a2 Drain box ten a3 It is covered and is this drain box ten a3. Exhaust hole ten a4 for exhausting the odor produced from the collected photoresist liquid in the lower part It is formed. Exhaust hole ten a4 An exhaust air pump which is mentioned later is open for free passage (graphic display abbreviation). In addition, although desorption of the scattering prevention cup 10 is carried out for the objects, such as the washing, in consideration of the workability in that case, effluent opening 10a is loosely inserted in the effluent piping ten a1, and the clearance exists in these joints. In this clearance part, it is the bellows-like covering ten a5. It is attached and they are effluent opening 10a and the effluent piping ten a1. It is constituted so that the odor leakage produced from the photoresist liquid adhering to a wall may be controlled.

[0019] Exhaust-port 10b is an exhaust pipe arrangement ten b1. Free passage connection is made. The exhaust pipe arrangement ten b1 is opened for free passage by the exhaust port 30 in a cup formed in one side face of an outer container 20. Free passage connection of the exhaust port 30 in a cup is made through piping 31 at the exhaust air pump 32 which is one of the utilities of a clean room. In addition, exhaust-port 10b and an exhaust pipe arrangement ten b1 It is the bellows-like covering ten b2 by the reason mentioned above at the joint. It is attached. Two dampers are formed in piping 31 in serial. One of these is manual damper 31a which adjusts an opening with hand control and adjusts a flow rate, and another side is automatic damper 31b which can adjust an opening according to the signal from the outside. In addition, one manual damper 31a is beforehand set up so that an indispensable exhaust air flow rate can be obtained,

and it is constituted so that an exhaust air flow rate becomes fixed by automatic damper 31b according to fluctuation of the exhaust air flow rate of the exhaust air pump 32 and it may be controlled.

[0020] Each configuration section mentioned above is blockaded with the outer container 20. That is, the punching board is not used for the pars basilaris ossis occipitalis as the conventional example was suited. Moreover, although covering which is not illustrated and in which the closing motion for a maintenance is free is attached in a lateral portion, the clearance is closed by the sealant etc. so that it may decrease as much as possible. furthermore, the air current DF which flows down from the upper part so that it may mention later -- efficient -- resistance -- in order to send caudad few, in the conventional example, the plate 100 (refer to drawing 5) currently arranged near the pars basilaris ossis occipitalis of the scattering prevention cup 10 is removed. The air-current extraction opening 41 which incorporates the air current by which temperature, humidity, air capacity, etc. were adjusted by the air-current controller 40 is formed in the up side face in this outer container 20. The air current is sent into the chamber 42 formed in the headroom in an outer container 20, and is supplied as a pure downflow DF through a filter 43. In addition, the flow rate of this downflow DF is made to call a flow rate alpha for convenience. Moreover, in order to raise the lock out degree of an outer container 20, the conveyance opening 45 for taking out a substrate [finishing / processing] is opened [an unsettled substrate is carried in or] and closed by the shutter 46. That is, interlocking connection of the part by which crookedness formation was carried out at the shape of a character of L of a shutter 46 is carried out at the rod of an air cylinder 12. It drops a shutter 46 and makes the conveyance opening 45 open while it drops the scattering prevention cup 10 to the revolution actuator 1 by shrinking that rod, in case this air cylinder 12 conveys a substrate all over drawing, as the two-dot chain line showed. While raising the scattering prevention cup 10 by expanding the rod, a shutter 46 is raised and the closedown of the conveyance opening 45 is carried out.

[0021] It is the side face of an outer container 20, and the exhaust port 50 outside a cup is formed down the exhaust port 30 in a cup. Free passage connection of the exhaust port 50 outside a cup is made through piping 51 at the exhaust air pump 52 which is one of the utilities of a clean room. Two dampers are arranged in piping 51 in serial, one of these is manual damper 51a which can adjust an opening by hand control, and another side is automatic damper 51b which can adjust an opening according to the signal from the outside. One manual damper 51a is constituted so that it may be controlled to become the setting-out exhaust air flow rate which an exhaust air flow rate mentions later according to a processing state, while it is beforehand set up so that an indispensable exhaust air flow rate can be obtained, and an exhaust air flow rate is uniformly controlled by automatic damper 51b according to fluctuation of the exhaust air flow rate of the exhaust air pump 52. In addition, automatic damper 51b is equivalent to the exhaust air flow control means in this invention. Moreover, the flow rate exhausted from the exhaust port 30 in a cup mentioned above on account of explanation is made into the exhaust air flow rate beta in a cup, and the flow rate exhausted from the exhaust port 50 outside a cup is called the exhaust air-cup outside flow rate gamma.

[0022] The fresh air intake 55 is formed under the conveyance opening 45 of an outer container 20. This fresh air intake 55 permits only the inflow of the open air into an outer container 20, and check valve 55a is arranged so that runoff to the exterior out of an outer container 20 may be forbidden. Although it mentions later for details, this fresh air intake 55 has the function to compensate a part for that air current that ran short so that Myst etc. may flow backwards and may not be sucked out of a cup 10, when the exhaust air-cup outside flow rate gamma of the exhaust port 50 outside a cup increases more than the difference of the flow rate alpha of Downflow DF, and the exhaust air flow rate beta in a cup of the exhaust port 30 in a cup.

[0023] In addition, the control in connection with spreading processing of the revolving speed control of electric motor 1b of the revolution actuator 1, migration control of the processing liquid supply nozzle 5 and supply control, supply control of the rinse from the back-side-rinse nozzle 11, expanding control of the rod of an air cylinder 12, etc., The downflow control of the air-current controller 40 which adjusts Downflow DF to predetermined temperature, humidity,

and a flow rate alpha and which is performed for accumulating, Generalization control is carried out by the control section 60 with exhaust air control of opening control of automatic damper 51b for adjusting opening control of automatic damper 31b for adjusting the exhaust air flow rate beta in a cup, and the exhaust air-cup outside flow rate gamma. In addition, the control section 60 builds in the memory which is not illustrated and performs processing based on the program (called a recipe) which shows the procedure equivalent to the timing diagram mentioned later memorized by this memory. Moreover, the setting-out exhaust air flow Q 1 of the exhaust air-cup outside flow rate gamma mentioned later and Q2 are beforehand set as a recipe. Therefore, according to a recipe, those values can be suitably set up now.

[0024] Next, actuation of the equipment mentioned above is explained with reference to the timing diagram of drawing 2 and drawing 3 , and drawing 4 . In addition, a continuous-line arrow head shows the flow of an air current typically, and when the air current contains Myst, an odor, and particle, the dotted-line arrow head shows drawing 3 and drawing 4 .

[0025] Drawing 2 is referred to. First, a substrate is conveyed in a time amount zero. While shrinking the rod of an air cylinder 12 and specifically dropping the scattering prevention cup 10, the conveyance opening 45 is made to open. The unsettled substrate supported by the conveyance arm which is not illustrated is received, and it is made to lay in spin-chuck 1a in this condition. If the conveyance arm which is not illustrated leaves the conveyance opening 45, while expanding the rod of an air cylinder 12 and raising the scattering prevention cup 12, a shutter 46 is raised and the closedown of the conveyance opening 45 is carried out. An outer container 20 will be blockaded by this. Furthermore, the splash support device and elevator style which are not illustrated are driven, and the processing liquid supply nozzle 5 is moved above near the center of rotation of Substrate W. This condition is in the condition shown in drawing 3 . In addition, in the usual condition, a control section 60 adjusts the opening of automatic damper 51b so that it may become little exhaust air flow Q 1 as compared with the exhaust air-cup outside flow rate gamma within the fixed section to taking out of a processing substrate after the supply interruption of photoresist liquid which is explained below (Q2).

[0026] The relation of each flow rate in this condition is controlled to become control 1, i.e., alpha-beta**Q, so that it may become alpha-beta**gamma. Therefore, as shown in drawing 3 , the downflow DF which flows in the scattering prevention cup 10 passes along exhaust-port 10b and the exhaust port 30 in a cup, and is exhausted with the exhaust air pump 32. On the other hand, the downflow DF which flows down a way outside the scattering prevention cup 10 incorporates the particle generated from an air cylinder 12, electric motor 1b, etc., and is exhausted with the exhaust air pump 52 through the exhaust port 50 outside a cup. Moreover, effluent piping ten a1 Adhering photoresist liquid (it adheres at the time of the substrate processing before this explanation) and an adhering drain box ten a3 The odor produced from the photoresist liquid collected inside flows in with Downflow DF toward the exhaust port 50 outside a cup.

[0027] And a control section 60 is time amount t1. It sets and supply of photoresist liquid is started to Substrate W through the processing liquid supply nozzle 5. Time amount t2 It sets, the revolution actuator 1 is controlled and it is time amount t3. A revolution is started so that the rotational frequency of Substrate W may turn into a rotational frequency R1. By this revolution actuation, the photoresist liquid currently supplied can be opened around Substrate W. time amount t1 from -- time amount t3 after predetermined time Setting, a control section 60 suspends supply of photoresist liquid. It is t2 the event of the rotational frequency of Substrate W beginning to rise towards a rotational frequency R1. The odor, Myst, etc. are delayed to some extent, and it is begun to reveal them, although it sets, the photoresist liquid supplied to the substrate W front face disperses around and it begins to generate Myst and an odor out of the scattering prevention cup 10. Then, time amount t2 In the delayed time amount t3, the opening of automatic damper 51b is enlarged synchronizing with the signal of the supply interruption of photoresist liquid, and the exhaust air-cup outside flow rate gamma is adjusted to the bigger exhaust air flow Q 2 than this from Q1. this time amount t3 from -- the time delay which an exhaust air flow rate increases gradually and is proportional to the volume of the [outer container 20 -- setting --] time amount t4 The exhaust air-cup outside flow rate gamma is set

to Q2. The relation of each flow rate in this condition is controlled to become control 1, i.e., alpha-beta<Q, so that it may become alpha-beta<gamma. Therefore, although compensated [come] by absorbing an air current including Myst in the scattering prevention cup 10 etc., if the amount of [which whose exhaust-air-cup outside flow rate gamma=Q 2 increased more than the flow rate which deducted the exhaust air flow rate beta in a cup from the flow rate alpha of Downflow DF, and ran short] flow rate becomes such, Myst which should be exhausted through the exhaust port 30 in a cup will be sucked out besides a cup, and it will do an adverse effect. However, since the open air flows so that a part for a lack flow rate may be compensated from a fresh air intake 55 as shown in drawing 3 , the above adverse effects can be prevented.
[0028] Therefore, so that the wall of the scattering prevention cup 10 top cup 7 may be crept up, or as Myst and the odor which were generated are extruded by Downflow DF, they are revealed out of the scattering prevention cup 10. It is caudad washed away by this Myst and odor that were revealed, and they are exhausted by Downflow DF through the exhaust port 50 outside a cup. Moreover, the particle produced from moving part, such as an air cylinder 12, is put on the open air which flows from Downflow DF and a fresh air intake 55, and is similarly exhausted from the exhaust port 50 outside a cup. the bellows-like covering ten a5 and ten b2 from -- the odor and Myst to reveal are also exhausted certainly, without revealing to the equipment exterior similarly. [moreover,] Therefore, it can prevent that a device defect arises in the substrate W which the air current containing Myst or particle circulates through, and carries out adhesion contamination at the table rear face of Substrate W consequently which is processed with this equipment. Moreover, since an odor, Myst, and particle are not revealed to the equipment exterior, either, while being able to prevent an odor, Myst, etc. touching the substrate in the exterior of this equipment, for example, degrading the sensibility of the high sensitivity photoresist coat [finishing / exposure] of a chemistry magnification resist etc., contamination of the substrate of the equipment exterior can be prevented.
[0029] Thus, while it has been in the condition that the exhaust air-cup outside flow rate gamma was made into flow Q 2, processing to Substrate W is performed as follows.
[0030] Time amount t5 It sets and is time amount t6. A control section 60 controls the revolution actuator 1 so that the rotational frequency of Substrate W turns into a rotational frequency R3 at the event. this rotational frequency R3 -- time amount t7 up to -- the photoresist coat of predetermined thickness is formed in the front face of Substrate W by holding. Also in this engine speed R3, although surplus photoresist liquid disperses and Myst and an odor occur, as it mentioned above, they are exhausted certainly.
[0031] Time amount t7 It sets and is time amount t8. It is made for the rotational frequency of Substrate W to be set to R1. And time amount t9 Or a rinse is supplied from the back-side-rinse nozzle 11 between time amount t10, and washing clearance of unnecessary photoresist liquid and unnecessary Myst adhering to the rear face of Substrate W is carried out. Then, in time amount t11, a rotational frequency is raised so that a rotational frequency may be set to R2 (lower more highly than a rotational frequency R1 than a rotational frequency R3) by time amount t12. By holding revolution actuation at this rotational frequency R2 to time amount t13, swing OFF dries Substrate W for the rinse supplied to the rear face of Substrate W. In addition, as the odor and Myst which are generated in the meantime were also mentioned above, they are certainly exhausted through the exhaust port 50 outside a cup. And it is made to synchronize with the signal and it is begun to return the exhaust air-cup outside flow rate gamma to the original flow Q 1 from flow Q 2, when a revolution stops (time amount t14) while lowering a rotational frequency so that a revolution may stop by time amount t14. That is, it is because Myst or the odor by the rinse generated by the revolution swing end do not need to decrease, so that they can be certainly exhausted through the exhaust port 30 in a cup at the event (time amount t14), and it is not necessary to exhaust through the exhaust port 50 outside a cup any longer.
[0032] In time amount t14, while beginning to decrease the exhaust air-cup outside flow rate gamma to flow Q 1, the substrate [finishing / processing] W is taken out and a new substrate is carried in. Thus, the processing to one substrate W can be completed and it can process to a substrate one by one by repeating actuation which was mentioned above and performing it after

time amount t14. Since it is made to exhaust by limiting the section which Myst etc. reveals rather than always performs the exhaust air from the exhaust port 50 outside a cup as mentioned above, while an insurance sanitary problem which was mentioned above is avoidable, in addition to the effectiveness that the substrate contamination inside equipment and substrate contamination of the equipment exterior can be prevented, the energy which exhaust air, cup outside takes can be saved. Although the utility of a clean room was used as exhaust air pumps 32 and 52 with above example equipment, it is effective especially when the pump of dedication is arranged in this equipment.

[0033] Thus, with the constituted equipment, since an odor, Myst, and particle are not revealed to the equipment exterior, either, an odor, Myst, etc. touch the substrate in the exterior of this equipment, and while being able to prevent degrading the sensibility of a high sensitivity photoresist coat [finishing / exposure], contamination of the substrate of the equipment exterior can be prevented. Therefore, in the process unit equipped with two or more processors, such as a rotating type substrate developer, a substrate thermal treatment equipment, and a substrate aligner, in one, since the rotating type substrate coater constituted in this way can prevent having an adverse effect on other equipments, it is suitable.

[0034] In addition, as for the timing which sets up the timing which changes the exhaust air-cup outside flow rate gamma into flow Q 2 from flow Q 1 just before Myst, an odor, or particle occurs and revealing from a cup 10 etc. as mentioned above, and is returned to flow Q 1 from flow Q 2, it is most desirable to double with the timing [Myst, an odor, or particle] no longer generating. However, you may always set it as the exhaust air flow Q 2 until the processing to all substrates is completed from the event of the processing initiation switch of equipment being pushed by the operator and substrate conveyance being started, at i.e., the event of processing being started, without carrying out adjustable [of for example the exhaust air-cup outside flow rate gamma] when the timing is not in agreement on the relation of the control signal of equipment. Moreover, you may make it always set the exhaust air-cup outside flow rate gamma as flow Q 2 until it is turned off from the condition that the power source of equipment was turned on irrespective of the processing state as mentioned above. Moreover, ON of a power source / automatic damper 51b which is not concerned off, but may always be made to perform exhaust air cup outside also in the condition that a power source is off, and adjusts an exhaust air flow rate in that case is unnecessary.

[0035] in addition , the timing (time amount t3 and t14) of the setting out exhaust air flow Q 1 of the exhaust air - cup outside flow rate gamma , Q2 , and the switch of those be set up for every recipe beforehand memorize by memory , and can set up now a proper flow rate and timing according to the contents of processing (for example , the engine speed which have big effect on generating of Myst , time amount or the class of photoresist liquid to supply , etc.) .

[0036] Moreover, although the above-mentioned example took and explained to the example the rotating type substrate coater which applies photoresist liquid as processing liquid, it is clear to be able to replace with photoresist liquid and for it to be able to apply also to the equipment which applies the polyimide liquid used as an insulator layer or a surface protective coat and SOG (Spin On Glass) liquid.

[0037] Moreover, although the above-mentioned example took and explained the rotating type substrate coater which applies processing liquid to the example, this invention is not limited to this equipment and can be applied to various rotating type substrate processors. For example, it is applicable to a rotating type substrate developer (called a spin developer), a rotating type substrate washing station (called a spin scrubber), etc.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing of longitudinal section showing the important section of the rotating type substrate coater concerning an example.
[Drawing 2] It is the timing diagram which shows an example of operation.
[Drawing 3] It is drawing with which explanation of operation is presented.
[Drawing 4] It is drawing with which explanation of operation is presented.
[Drawing 5] It is drawing of longitudinal section showing the important section of the rotating type substrate coater concerning the conventional example.
[Description of Notations]
1 -- Revolution Actuator (Revolution Driving Means)
1a -- Spin chuck
1b -- Electric motor
5 -- Processing Liquid Supply Nozzle (Processing Liquid Supply Means)
10 -- Scattering Prevention Cup
10a -- Effluent opening
10b -- Exhaust port
11 -- Back-Side-Rinse Nozzle (Processing Liquid Supply Means)
20 -- Outer Container
30 -- Exhaust Port in Cup
50 -- Exhaust Port outside Cup
51b -- Automatic damper (exhaust air flow control means)
DF -- Downflow
alpha -- Flow rate of a downflow
beta -- Exhaust air flow rate in a cup
gamma -- Exhaust air-cup outside flow rate

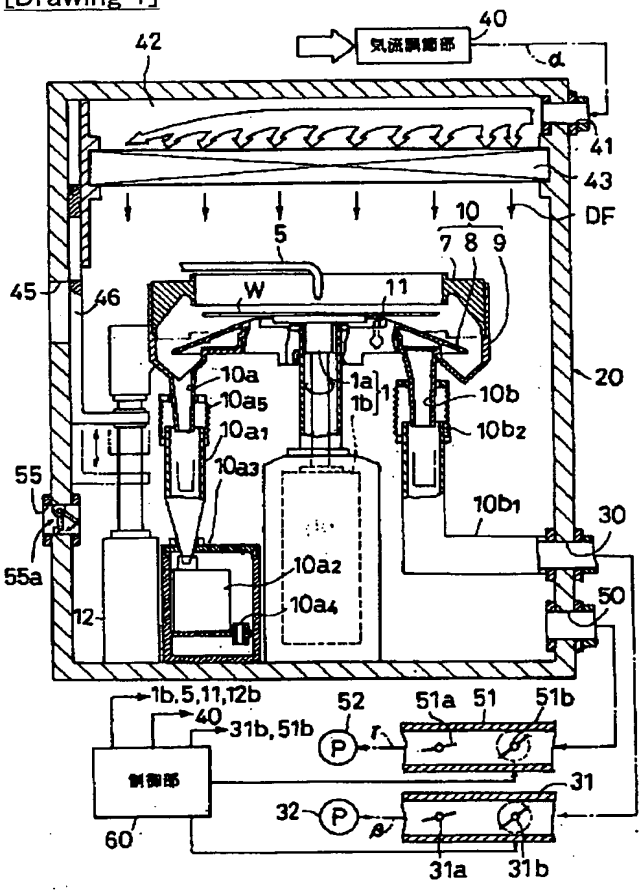
[Translation done.]

* NOTICES *

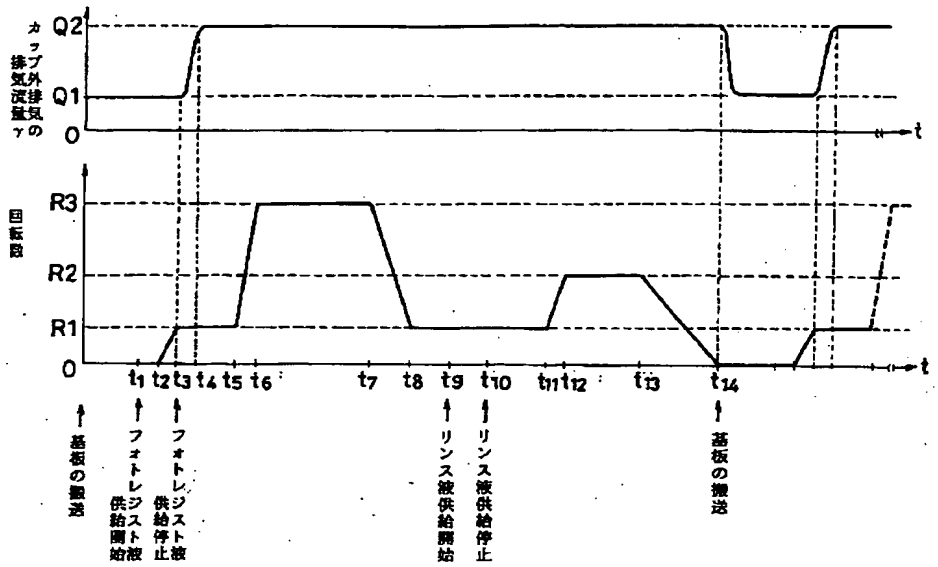
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

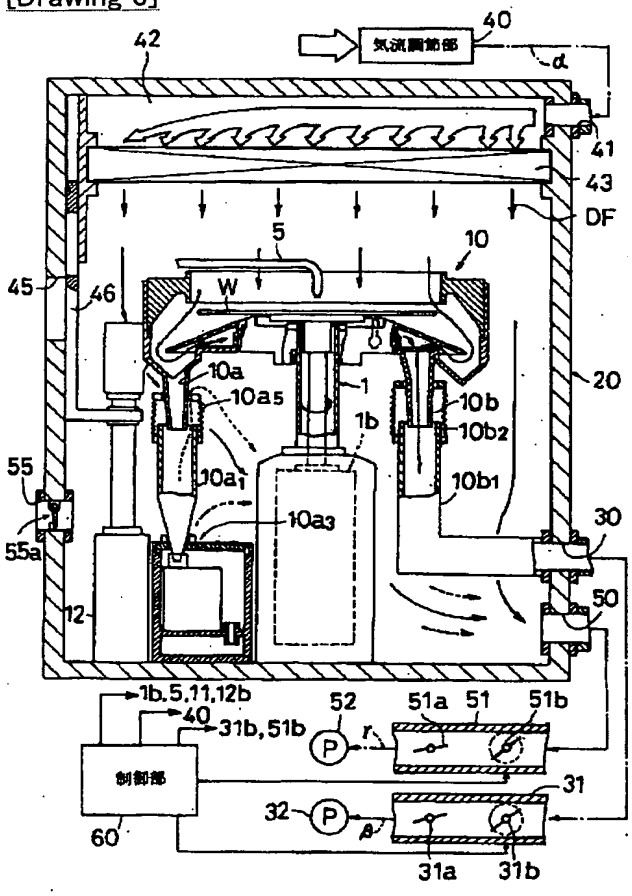
[Drawing 1]



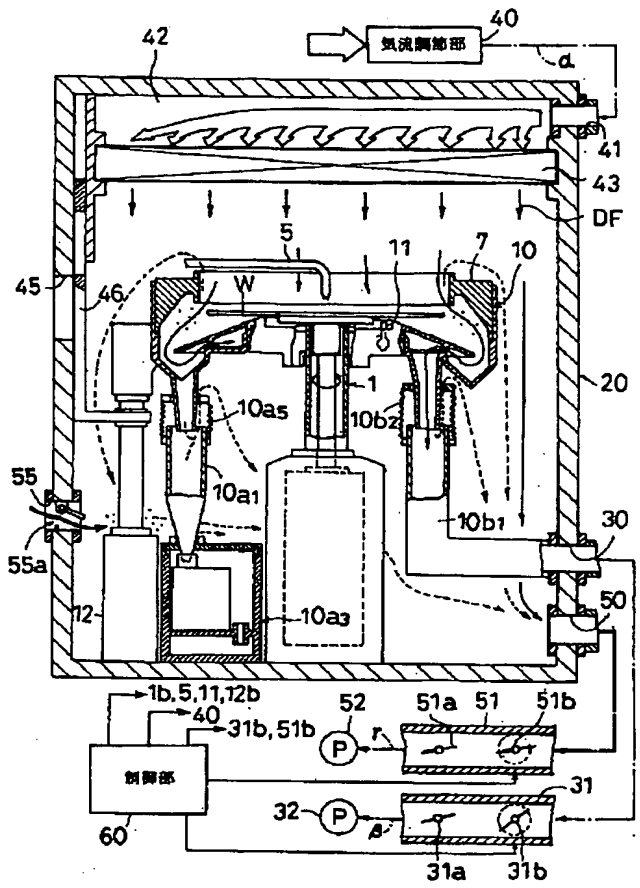
[Drawing 2]



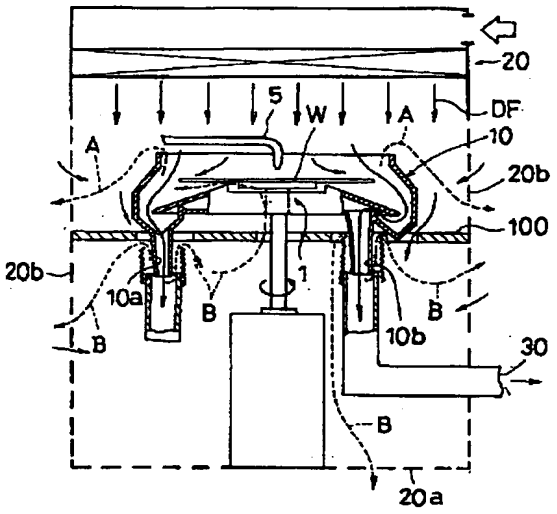
[Drawing 3]



[Drawing 4]



[Drawing 5]



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			21/30	５６９Ｃ	

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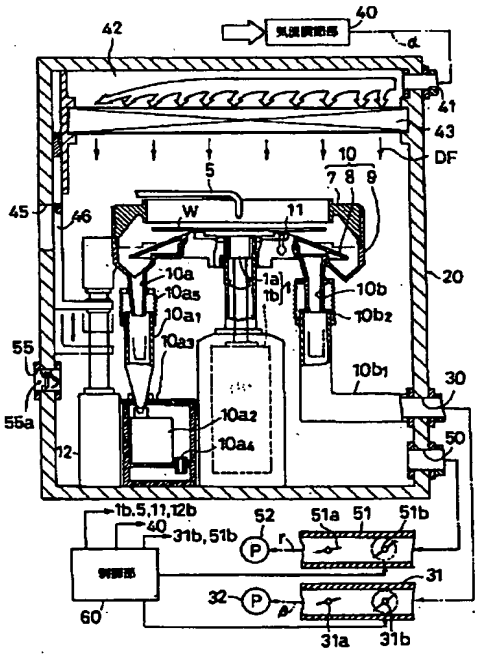
(54)【発明の名称】　回転式基板処理装置

(57)【要約】

【課題】　飛散防止カップ外に漏洩したミストや臭気を排気することにより、安全衛生上の問題を回避することができるとともに、装置内部での基板汚染や装置外部の基板汚染を防止することができる。

【解決手段】　基板Ｗを回転駆動する回転駆動部１と、フォトレジスト液を供給する処理液供給ノズル５と、基板Ｗの周囲を囲ってフォトレジスト液の飛散を防止する飛散防止カップ１０と、前記各部を覆い、上方から下方へ向かうダウンフローＤＦを連通可能に構成され、飛散防止カップ１０内を排気するカップ内排気口３０を形成されている外容器２０と、を備える回転式基板塗布装置において、外容器２０は、飛散防止カップ１０の周囲のダウンフローＤＦを排気するカップ外排気口５０を形成されている。カップ外排気口５０には、排気流量を調節する自動ダンパー５１ｂが連通されている。



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【特許請求の範囲】

【請求項１】　基板を保持して回転駆動する回転駆動手段と、前記基板に対して処理液を供給する処理液供給手段と、前記基板の周囲を囲って処理液の飛散を防止する飛散防止カップと、前記回転駆動手段と、前記処理液供給手段と、前記飛散防止カップとを覆い、上方から下方へ向かう気流（ダウンフロー）を連通可能に構成され、前記飛散防止カップ内を排気するカップ内排気口を形成されている外容器と、を備える回転式基板処理装置において、

前記外容器は、前記飛散防止カップの周囲のダウンフローを排気するカップ外排気口を形成されていることを特徴とする回転式基板処理装置。

【請求項２】　請求項１に記載の回転式基板処理装置において、前記カップ外排気口を通しての排気流量を調整する排気流量調整手段を連通接続されていることを特徴とする回転式基板処理装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、半導体ウエハ、フォトマスク用のガラス基板、液晶表示装置用のガラス基板、光ディスク用の基板等の基板に対して、フォトレジスト液、リンス液、現像液、洗浄液などの処理液を供給して所定の処理を施す装置に係り、特に処理に伴って発生するミストや臭気を排気する技術に関する。

【０００２】

【従来の技術】従来のこの種の回転式基板処理装置として、例えば、処理の対象である基板を保持して回転駆動する回転駆動部と、その基板に対して処理液であるフォトレジスト液を供給する処理液供給ノズルと、基板の周囲を囲ってフォトレジスト液の飛散を防止する飛散防止カップと、前記各部を覆い、上方から下方へ向かう気流（ダウンフロー）を連通可能に構成され、飛散防止カップ内を排気するカップ内排気口を形成された外容器と、を備えている回転式基板塗布装置（スピンコータとも呼ばれる）が挙げられる。

【０００３】このような装置の構成について、その要部を示す図５の縦断面図を参照して以下に説明する。図中、符号１は、電動モータにより回転駆動されるスピンチャックを含む、支持した基板Ｗを回転駆動する回転駆動部である。基板Ｗの回転中心付近の上方には、基板Ｗに対してフォトレジスト液を供給するための処理液供給ノズル５が位置している。基板Ｗの周囲は、フォトレジスト液の飛散を防止するための飛散防止カップ１０により囲われている。この飛散防止カップ１０の底部には、周囲に飛散したフォトレジスト液を回収するための排液口１０ａと、上方から流入して基板Ｗの周縁を流下する気流を排気するための排気口１０ｂとが形成されている。また、回転駆動部１と、処理液供給ノズル５と、飛散防止カップ１０とは、上方から下方へ向かう清浄な気流（以下、ダウンフローと称する）ＤＦを有する外容器２０により覆われている。この外容器２０は、フォトレジスト液が飛散して霧状となったもの（以下、ミストと称する）やパーティクルを、基板Ｗの周縁を流下する気流に乗せて排気するために、飛散防止カップ１０の排気口１０ｂに連通接続されたカップ内排気口３０を形成されている。このカップ内排気口３０は、クリーンルームに設置されているユーティリティの１つである排気ポンプに接続されて、常時所定の流量で排気されている。

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【０００４】外容器２０の底部は、上方から流下するダウンフローＤＦが、外容器２０内部に浮遊するパーティクルを乗せて排出されるように、多数の小孔が形成されたパンチングプレート２０ａにより構成されている。また、外容器２０の周囲側面部は、側面カバー２０ｂにより囲われているが、主としてメンテナンスのために開閉可能に構成されているため、多くの隙間を有する。また、飛散防止カップ１０の下方には、メンテナンスの際に各種の部品が底部に落下することを防止したり、外容器２０の下方にある各構成部品などが見えないようにするためのプレート１００が配設されている。

【０００５】このように構成されている装置では、フォトレジスト液の供給により基板Ｗの周囲に飛散したフォトレジスト液は、図中に実線矢印で示すように排液口１０ａを介して回収され、基板Ｗの周囲に飛散して生じたミストや、フォトレジスト液に含まれる有機溶剤やアルカリ成分に起因する臭気は、飛散防止カップ１０内の実線矢印で示すように、排気口１０ｂを介してカップ内排気口３０から排気されるようになっている。

【０００６】

【発明が解決しようとする課題】しかしながら、このような構成を有する従来例の場合には、次のような問題がある。すなわち、上述したミストや臭気の一部は、主として基板Ｗの回転駆動に伴って発生する気流や、流下するダウンフローＤＦにより、図中の符号Ａで示した点線矢印のように、排気口１０ｂからの排気に逆らって飛散防止カップ１０の内壁を這い上がり、飛散防止カップ１０の外へ漏れ出し、ダウンフローＤＦに押し出されるようにして側面カバー１０ｂの隙間を通って装置外部へ流出するので、この装置付近にある他の基板に対して悪影響を及ぼしたり、安全衛生上の問題を引き起こすという問題点がある。上記の基板に対する悪影響は、特に、最近の半導体プロセスの微細加工が進展するに従って採用されている、いわゆる化学増幅レジストなどの高感度フォトレジスト被膜に対する影響であり、具体的には、高感度フォトレジスト被膜を形成された基板が露光処理により所定パターンを露光されたあと、高感度フォトレジスト被膜が有機溶剤やアルカリ成分を含む臭気に触れることにより感度が大幅に劣化することである。また、他の影響としては、基板にミストやパーティクルが付着することによりデバイス欠陥を生じるということが挙げら

れる。

【０００７】また、排液口１０ａおよび排気口１０ｂの継ぎ目には、主として飛散防止カップ１０を洗浄するために着脱する際の作業性を考慮して隙間が設けられており、これらの隙間には蛇腹状のカバーが取り付けてはあるが、これらの隙間から臭気やミストが漏れ出す（図中に符号Ｂで示す点線矢印）。漏れ出た臭気やミストは、やはりダウンフローＤＦに押し出されるようにしてパンチングプレート２０ａや側面カバー２０ｂの隙間を通って装置外部へ流出し、上記と同様の問題を引き起こす。また、漏れ出た臭気やミストの一部は、装置外部へ流出することなく、回転駆動されて負圧となっている基板Ｗの裏面回転中心付近に吸い込まれるように循環して、処理中の基板Ｗの裏面や表面に付着する。これにより処理中の基板Ｗを汚染してデバイス欠陥を引き起こすという問題も生じる。

【０００８】なお、上記のミストや臭気の漏洩を防止するためにカップ内排気口３０の排気流量を増大させることが容易に考えられるが、これは以下の理由により行うことができない。すなわち、基板Ｗに供給されたフォトレジスト液は、高速回転により所定膜厚の被膜に形成されるが、その際に、飛散防止カップ１０内の排気口１０ｂの排気流量を多くすると、この排気により生じる気流により基板Ｗの周縁を流下する気流の流量が増大して、フォトレジスト液に含まれる有機溶剤やアルカリ成分の揮発速度が増し、その結果、基板Ｗの中心付近と周縁部との膜厚に差異が生じる。したがって、最近の装置では飛散防止カップ１０内の排気流量を弱める傾向がある。その結果、上述したようなミストや臭気（図中の符号Ａ，Ｂ）の漏洩に起因する問題が顕著に生じているのが現実である。

【０００９】本発明は、このような事情に鑑みてなされたものであって、飛散防止カップ外に漏洩したミストや臭気を排気することにより、安全衛生上の問題を回避することができるとともに、装置内部での基板汚染や装置外部の基板汚染を防止することができる回転式基板処理装置を提供することを目的とする。

【００１０】

【課題を解決するための手段】本発明は、このような目的を達成するために、次のような構成をとる。すなわち、請求項１に記載の回転式基板処理装置は、基板を保持して回転駆動する回転駆動手段と、前記基板に対して処理液を供給する処理液供給手段と、前記基板の周囲を囲って処理液の飛散を防止する飛散防止カップと、前記回転駆動手段と、前記処理液供給手段と、前記飛散防止カップとを覆い、上方から下方へ向かう気流（ダウンフロー）を連通可能に構成され、前記飛散防止カップ内を排気するカップ内排気口を形成されている外容器と、を備える回転式基板処理装置において、前記外容器は、前記飛散防止カップの周囲のダウンフローを排気するカップ外排気口を形成されていることを特徴とするものである。

【００１１】また、請求項２に記載の回転式基板処理装置は、前記カップ外排気口を通しての排気流量を調整する排気流量調整手段を連通接続されていることを特徴とするものである。

【００１２】

【作用】請求項１に記載の発明の作用は次のとおりである。回転駆動手段により回転されている基板に対して、処理液供給手段を介して処理液を供給すると、基板の周囲に処理液が飛散する。このとき、飛散防止カップの内壁に処理液が衝突すること等により、ミストが生じてカップ内に浮遊するとともに、その成分、例えば、有機溶剤やアルカリ成分が臭気となってカップ内に滞留する。カップ内に浮遊あるいは滞留するミストや臭気は、外容器に形成されたカップ内排気口を介して排出される。排出されなかったミストや臭気あるいは配管の継ぎ目などか漏れ出たミストや臭気は、飛散防止カップの外部に漏洩するが、外容器内を浮遊するパーティクルとともにダウンフローにより外容器内を流下し、飛散防止カップの周囲を排気するカップ外排気口を介して排気される。したがって、外容器の内部のミスト、臭気およびパーティクルは、カップ内排気口またはカップ外排気口を介して全て排気されるので、装置内部でのそれらの循環を防止することができるとともに、それらが外容器外に漏洩しないようにすることができる。

【００１３】また、請求項２に記載の発明の作用は次のとおりである。すなわち、飛散防止カップ内に滞留するミストや臭気、パーティクルは、外容器のダウンフローとともにカップ内排気口を介して排気され、カップから漏れ出たものはカップ外排気口から排気されるが、カップ外排気口の排気流量が多過ぎると、カップ内からミストや臭気、パーティクルが逆流して吸い出すことになり、カップ外排気口の排気流量が少なすぎると、カップ内から漏れ出たミストなどが外容器内に滞留することになる。そこで、外容器のダウンフローの流量とカップ内排気口の排気流量との関係に基づき、排気流量調整手段を介してカップ外排気口の排気流量を調整することにより、カップ内のミストなどを吸い出すことなく、外容器内にミストなどが滞留することなく、カップ内から漏れ出たミスト等を確実に排気することができる排気流量に調節することができる。

【００１４】

【発明の実施の形態】以下、図面を参照して本発明の一実施例を説明する。図１は、本発明の回転式基板処理装置の一例である回転式基板塗布装置の概略構成を示す縦断面図である。

【００１５】図中、符号１ａは、処理の対象である基板Ｗ（例えば、半導体ウエハ）をほぼ水平に支持するスピンチャックである。このスピンチャック１ａは、その底

部を、回転軸を介して電動モータ１ｂに連動連結されている。電動モータ１ｂは、ハウジングに収納された状態で、後述する外容器の底部に固定されている。これらのスピンチャック１ａと電動モータ１ｂとは、本発明における回転駆動手段に相当する回転駆動部１を構成している。

【００１６】スピンチャック１ａの上方には、処理液であるフォトレジスト液を供給するための処理液供給ノズル５が配置されており、その下方に向けられた先端部が回転中心付近に位置するように設けられている。この処理液供給ノズル５は、図示しない揺動支持機構によってその基端部を揺動自在に片持ち支持されており、その先端部が基板Ｗの上方から外れた待機位置と、図示した吐出位置とにわたって移動されるとともに、それぞれの位置において図示しない昇降機構によって昇降可能に構成されている。なお、処理液供給ノズル５は、本発明における処理液供給手段に相当するものである。

【００１７】基板Ｗの周囲は、フォトレジスト液が飛散することを防止するための飛散防止カップ１０によって囲われている。飛散防止カップ１０は、基板Ｗを搬送するための開口および基板Ｗの周縁部から周囲に飛散するフォトレジスト液を下方に案内する傾斜面を有する上カップ７と、流下する気流を整流するための平面視円形状の整流板８と、排液を回収するための下カップ９とから構成されている。整流板８は下カップ９の内周部に嵌め込まれており、上カップ７はその下端の外周面を下カップ９の内周面に嵌め込まれている。下カップ９は、その底部にリング状の排液ゾーンを有し、その３箇所（図では１箇所のみを示している）に、飛散したフォトレジスト液を回収するための排液口１０ａを形成されている。また、その排液ゾーンの内側には、整流板８に覆われた排気ゾーンが形成されており、１箇所に、基板Ｗの周縁を流下する気流（ミストやパーティクル、臭気を含む）を排気するための排気口１０ｂが形成されている。また、整流板８の回転中心側には、基板Ｗの周縁部裏面に回り込んだフォトレジスト液や裏面に付着したミストなどを洗浄除去するためにリンス液を、基板Ｗの裏面周縁部に向けて供給するためのバックリンスノズル１１が埋設されている。飛散防止カップ１０は、その下カップ９の外側面をエアシリンダ１２のロッドに連動連結されており、エアシリンダ１２のロッドを伸縮させることにより回転駆動部１に対して昇降するようになっている。なお、飛散防止カップ１０を固定として、回転駆動部１をカップ１０に対して昇降させるようにしてもよい。また、バックリンスノズル１１は、上述した処理液供給ノズル５と同様に、本発明における処理液供給手段に相当するものである。

【００１８】排液口１０ａは、排液配管１０a_1に連通接続されており、その排液配管１０a_1は、その下端部がドレインタンク１０a_2に差し入れられている。排液口１０ａに流れ込んだフォトレジスト液は、排液配管１０a_1を通ってドレインタンク１０a_2に回収されるようになっている。ドレインタンク１０a_2は、ドレインボックス１０a_3に覆われており、このドレインボックス１０a_3の下部には回収したフォトレジスト液から生じる臭気を排気するための排気孔１０a_4が形成されている。排気孔１０a_4は、後述するような排気ポンプなどに連通されている（図示省略）。なお、飛散防止カップ１０は、その洗浄などの目的のために脱着されるが、その際の作業性を考慮して、排液口１０ａは、排液配管１０a_1に緩挿されており、これらの継ぎ目には隙間が存在している。この隙間部分には、蛇腹状カバー１０a_5が取り付けられていて、排液口１０ａや排液配管１０a_1の内壁に付着したフォトレジスト液から生じる臭気漏れを抑制するように構成されている。

【００１９】排気口１０ｂは、排気配管１０b_1に連通接続されている。排気配管１０b_1は、外容器２０の一側面に形成されたカップ内排気口３０に連通されている。カップ内排気口３０は、配管３１を介して、クリーンルームのユーティリティの１つである排気ポンプ３２に連通接続されている。なお、排気口１０ｂと排気配管１０b_1との継ぎ目には、上述した理由により蛇腹状カバー１０b_2が取り付けられている。配管３１には、２つのダンパーが直列的に設けられている。その一方は、手動により開度を調整して流量を調整する手動ダンパー３１ａであり、他方は外部からの信号に応じて開度を調節可能な自動ダンパー３１ｂである。なお、一方の手動ダンパー３１ａは、最低限必要な排気流量を得られるように予め設定されており、排気ポンプ３２の排気流量の変動に応じて自動ダンパー３１ｂにより排気流量が一定となるように制御されるように構成されている。

【００２０】上述した各構成部は、外容器２０によって閉塞されている。つまり、従来例にあったようにその底部にはパンチングボードは用いられていない。また、側面部には、図示しないメンテナンス用の開閉自在のカバー等は取り付けられてはいるが、その隙間は極力少なくなるようにシール材等で塞がれている。さらに、後述するように上方から流下する気流ＤＦを効率良く抵抗少なく下方に送るために、従来例では飛散防止カップ１０の底部付近に配設されていたプレート１００（図５参照）は除かれている。この外容器２０内の上部側面には、気流調節部４０により温度、湿度および風量などが調節された気流を取り込む気流採取口４１が形成されている。その気流は、外容器２０内の上方空間に形成されたチャンバー４２に送り込まれ、フィルター４３を通って清浄なダウンフローＤＦとして供給されるようになっている。なお、このダウンフローＤＦの流量を、便宜上、流量αと称することにする。また、外容器２０の閉塞度合いを高めるために、未処理の基板を搬入したり、処理済の基板を搬出するための搬送開口４５は、シャッター４

６により開閉されるようになっている。すなわち、シャッター４６のＬの字状に屈曲形成された部分は、エアシリンダ１２のロッドに連動連結されている。このエアシリンダ１２は、図中に二点鎖線で示したように、基板を搬送する際に、そのロッドを収縮させることにより、飛散防止カップ１０を回転駆動部１に対して下降させるとともに、シャッター４６を下降させて搬送開口４５を開放させる。そのロッドを伸長させることにより、飛散防止カップ１０を上昇させるとともに、シャッター４６を上昇させて搬送開口４５を閉止させる。

【００２１】外容器２０の側面であって、カップ内排気口３０の下方には、カップ外排気口５０が形成されている。カップ外排気口５０は、配管５１を介して、クリーンルームのユーティリティの１つである排気ポンプ５２に連通接続されている。配管５１には、２つのダンパーが直列的に配設されており、その一方は手動により開度を調節可能な手動ダンパー５１ａであり、他方は外部からの信号に応じて開度を調節することができる自動ダンパー５１ｂである。一方の手動ダンパー５１ａは、最低限必要な排気流量を得られるように予め設定されており、排気ポンプ５２の排気流量の変動に応じて自動ダンパー５１ｂにより排気流量が一定に制御されるとともに、処理状態に応じて排気流量が後述する設定排気流量となるように制御されるように構成されている。なお、自動ダンパー５１ｂは、本発明における排気流量調整手段に相当する。また、説明の都合上、上述したカップ内排気口３０から排気される流量をカップ内排気流量βとし、カップ外排気口５０から排気される流量をカップ外排気流量γと称する。

【００２２】外容器２０の搬送開口４５の下方には、外気取り入れ口５５が形成されている。この外気取り入れ口５５は、外容器２０内への外気の流入のみを許容し、外容器２０内から外部への流出を禁止するように逆止弁５５ａが配設されている。この外気取り入れ口５５は、詳細については後述するが、ダウンフローＤＦの流量αとカップ内排気口３０のカップ内排気流量βとの差分よりもカップ外排気口５０のカップ外排気流量γが多くなった場合に、カップ１０からミストなどが逆流して吸い出されることがないように、その不足した気流分を補う機能を有するものである。

【００２３】なお、回転駆動部１の電動モータ１ｂの回転数制御、処理液供給ノズル５の移動制御や供給制御、バックリンスノズル１１からのリンス液の供給制御、エアシリンダ１２のロッドの伸長制御などの塗布処理にかかわる制御と、ダウンフローＤＦを所定の温度、湿度、流量αに調節するために行う気流調節部４０のダウンフロー制御と、カップ内排気流量βを調節するための自動ダンパー３１ｂの開度制御、カップ外排気流量γを調節するための自動ダンパー５１ｂの開度制御の排気制御とは、制御部６０によって統括制御されるようになっている。なお、制御部６０は、図示しないメモリを内蔵しており、このメモリに記憶されている、後述するタイムチャートに相当する処理手順を示すプログラム（レシピーとも称される）に基づいて処理を実行するようになっている。また、後述するカップ外排気流量γの設定排気流量Ｑ１，Ｑ２は、予めレシピーに設定されるようになっている。したがって、レシピーに応じて適宜にそれらの値を設定することができるようになっている。

【００２４】次に、図２のタイムチャートおよび図３、図４を参照して、上述した装置の動作について説明する。なお、図３および図４においては、気流の流れを模式的に実線矢印で示し、その気流がミストや臭気、パーティクルを含む場合には点線矢印で示している。

【００２５】図２を参照する。まず、時間原点においては、基板の搬送を行う。具体的には、エアシリンダ１２のロッドを収縮させて、飛散防止カップ１０を下降させるとともに、搬送開口４５を開放させる。この状態で、図示しない搬送アームに支持された未処理基板を受け入れて、スピンチャック１ａに載置させる。図示しない搬送アームが搬送開口４５から退出すると、エアシリンダ１２のロッドを伸長させて、飛散防止カップ１２を上昇させるとともに、シャッター４６を上昇させて搬送開口４５を閉止させる。これにより外容器２０は閉塞されることになる。さらに、図示しない揺動支持機構や昇降機構を駆動して、処理液供給ノズル５を、基板Ｗの回転中心付近の上方に移動させる。この状態が、図３に示した状態である。なお、制御部６０は、通常の状態においては、以下に説明するようなフォトレジスト液の供給停止以降ないし処理基板の搬出までの一定の区間内におけるカップ外排気流量γ（Ｑ２）に比較して少ない排気流量Ｑ１となるように、自動ダンパー５１ｂの開度を調節するようになっている。

【００２６】この状態における各流量の関係は、α－β≒γとなるように制御、つまり、α－β≒Ｑ１となるように制御されている。したがって、図３に示すように、飛散防止カップ１０内に流入するダウンフローＤＦは、排気口１０ｂおよびカップ内排気口３０を通って、排気ポンプ３２により排気される。その一方、飛散防止カップ１０の外方を流下するダウンフローＤＦは、例えば、エアシリンダ１２や電動モータ１ｂなどから発生するパーティクルを取り込んでカップ外排気口５０を通って排気ポンプ５２により排気される。また、例えば、排液配管１０ａ$_1$に付着しているフォトレジスト液（この説明以前の基板処理時に付着）やドレインボックス１０ａ$_1$内に回収されたフォトレジスト液から生じる臭気は、カップ外排気口５０に向かってダウンフローＤＦとともに流れ込む。

【００２７】そして、制御部６０は、時間ｔ$_1$において、処理液供給ノズル５を介して基板Ｗにフォトレジスト液の供給を開始する。時間ｔ$_2$において、回転駆動部

１を制御して時間t_1にて基板Ｗの回転数が回転数Ｒ１となるように回転を開始する。この回転駆動により、供給されているフォトレジスト液は、基板Ｗの周囲に拡げられる。時間t_1から所定時間後の時間t_2において、制御部６０は、フォトレジスト液の供給を停止する。基板Ｗの回転数が回転数Ｒ１に向けて上昇され始めた時点t_2において、基板Ｗ表面に供給されたフォトレジスト液は周囲に飛散して、ミストや臭気を発生し始めるが、その臭気やミストなどはある程度遅延して飛散防止カップ１０外に漏洩し始める。そこで、時間t_2より遅延した時間t_3において、フォトレジスト液の供給停止の信号に同期して自動ダンパー５１ｂの開度を大きくし、カップ外排気流量γをＱ１からこれより大きな排気流量Ｑ２に調整する。この時間t_3から、徐々に排気流量が増大して、〔外容器２０の容積に比例する遅延時間をおいて〕時間t_4でカップ外排気流量γがＱ２となる。この状態における各流量の関係は、$\alpha-\beta<\gamma$となるように制御、つまり、$\alpha-\beta<Q1$となるように制御されている。したがって、ダウンフローＤＦの流量αからカップ内排気流量βを差し引いた流量よりもカップ外排気流量γ＝Ｑ２が多くなって、不足した流量分は飛散防止カップ１０内のミストなどを含む気流を吸い込むことで補われるようになるが、このようになるとカップ内排気口３０を介して排気されるはずのミストなどがカップ外に吸い出されて悪影響を及ぼす。しかしながら、図３に示すように、外気取り入れ口５５から不足流量分を補うように外気が流入するので、上記のような悪影響を防止することができる。

【００２８】したがって、発生したミストや臭気は、飛散防止カップ１０の上カップ７の内壁を這い上がるように、または、ダウンフローＤＦによって押し出されるようにして、飛散防止カップ１０外に漏洩する。この漏洩したミストや臭気は、ダウンフローＤＦによって下方に押し流されて、カップ外排気口５０を介して排気される。また、エアシリンダ１２などの可動部から生じたパーティクルは、ダウンフローＤＦや、外気取り入れ口５５から流入する外気に乗せられて、同様にカップ外排気口５０から排気される。また、蛇腹状カバー$10a_1$，$10b_1$から漏洩する臭気やミストも、同様に装置外部に漏洩することなく確実に排気される。したがって、ミストやパーティクルを含む気流が循環して基板Ｗの表裏面に付着汚染し、その結果、この装置で処理している基板Ｗにデバイス欠陥が生じることを防止することができる。また、装置外部にも臭気やミスト、パーティクルは漏洩しないので、この装置の外部にある基板に臭気やミストなどが触れて、例えば、化学増幅レジストなどの露光済の高感度フォトレジスト被膜の感度を劣化させることを防止することができるとともに、装置外部の基板の汚染を防止することができる。

【００２９】このようにカップ外排気流量γが流量Ｑ２とされた状態のまま、以下のように基板Ｗに対する処理が施される。

【００３０】時間t_5において、時間t_6の時点で基板Ｗの回転数が回転数Ｒ３となるように、制御部６０は回転駆動部１を制御する。この回転数Ｒ３を時間t_7まで保持することにより、基板Ｗの表面には所定膜厚のフォトレジスト被膜が形成される。この回転数Ｒ３においても、余剰なフォトレジスト液が飛散してミストや臭気が発生するが、上述したようにしてそれらは確実に排気される。

【００３１】時間t_7において、時間t_8にて基板Ｗの回転数がＲ１となるようにする。そして、時間t_8ないし時間t_{10}の間、バックリンスノズル１１からリンス液を供給して、基板Ｗの裏面に付着した不要なフォトレジスト液やミストを洗浄除去する。その後、時間t_{11}において、時間t_{12}にて回転数がＲ２（回転数Ｒ１より高く回転数Ｒ３よりも低い）となるように回転数を上昇させる。この回転数Ｒ２での回転駆動を時間t_{13}まで保持することにより、基板Ｗの裏面に供給されたリンス液を振り切って基板Ｗを乾燥させる。なお、この間に発生する臭気やミストも、上述したようにしてカップ外排気口５０を介して確実に排気される。そして、時間t_{14}にて回転が停止するように回転数を下げるとともに、回転が停止した時点（時間t_{14}）において、その信号に同期させてカップ外排気流量γを流量Ｑ２から元の流量Ｑ１に戻し始める。つまり、回転振り切りにより発生したリンス液によるミストや臭気は、その時点（時間t_{14}）においてカップ内排気口３０を介して確実に排気できるほど減少し、もはやカップ外排気口５０を介して排気する必要がないからである。

【００３２】時間t_{14}において、カップ外排気流量γを流量Ｑ１に減少させ始めるとともに、処理済の基板Ｗを搬出して新たな基板を搬入する。このようにして１枚の基板Ｗに対する処理が完了し、時間t_{14}以降、上述したような動作を繰り返し行うことによって順次に基板に対して処理を施すことができる。上述したように、カップ外排気口５０からの排気を常時行うのではなく、ミストなどが漏洩する区間を限定して排気を行うようにしているので、上述したような、安全衛生上の問題を回避することができるとともに、装置内部の基板汚染や装置外部の基板汚染を防止することができる効果に加えて、カップ外排気に要するエネルギーを節約することができる。上記の実施例装置では、排気ポンプ３２，５２としてクリーンルームのユーティリティを利用したが、この装置に専用のポンプを配設したような場合には特に効果的である。

【００３３】このように構成された装置では、装置外部にも臭気やミスト、パーティクルは漏洩しないので、この装置の外部にある基板に臭気やミストなどが触れて、露光済の高感度フォトレジスト被膜の感度を劣化させる

ことを防止することができるとともに、装置外部の基板の汚染を防止することができる。したがって、このように構成された回転式基板塗布装置は、回転式基板現像装置、基板熱処理装置、基板露光装置などの複数の処理装置を一体的に備えたプロセス装置などにおいて、他の装置に悪影響を与えることを防止できるので好適である。

【００３４】なお、上述したようにカップ外排気流量γを流量Ｑ１から流量Ｑ２に変えるタイミングは、ミストや臭気、あるいはパーティクルが発生してカップ１０などから漏洩する直前に設定し、流量Ｑ２から流量Ｑ１に戻すタイミングは、ミストや臭気、あるいはパーティクルが発生しなくなるタイミングに合わせるのが最も好ましい。しかしながら、そのタイミングが装置の制御信号の関係上、一致しないような場合には、例えば、カップ外排気流量γを可変することなく、装置の処理開始スイッチがオペレータにより押下されて基板搬送が開始された時点、つまり、処理が開始された時点から全ての基板に対する処理が完了するまで、常時排気流量Ｑ２に設定しておくようにしてもよい。また、上記のように処理状態にかかわらず、装置の電源がオンされた状態からオフされるまでの間は、常時カップ外排気流量γを流量Ｑ２に設定するようにしてもよい。また、電源のオン／オフにかかわらず、電源がオフの状態でも常時カップ外排気を行うようにしてもよく、その場合には排気流量を調節する自動ダンパー５１ｂは不要である。

【００３５】なお、カップ外排気流量γの設定排気流量Ｑ１，Ｑ２およびその切り換えのタイミング（時間 t_3，t_4）は、予めメモリに記憶されているレシピー毎に設定されているものであり、その処理内容（例えば、ミストの発生に大きな影響を与える回転数や時間または、供給するフォトレジスト液の種類など）に応じて適宜の流量およびタイミングを設定することができるようになっている。

【００３６】また、上記の実施例では、処理液としてフォトレジスト液を塗布する回転式基板塗布装置を例に採って説明したが、フォトレジスト液に代えて、絶縁膜や表面保護膜として利用されるポリイミド液やSOG(Spin On Glass)液を塗布する装置にも適用可能であることは明らかである。

【００３７】また、上記の実施例では、処理液を塗布する回転式基板塗布装置を例に採って説明したが、本発明はこの装置に限定されるものではなく、種々の回転式基板処理装置に適用可能である。例えば、回転式基板現像装置（スピンデベロッパーとも称される）、回転式基板洗浄装置（スピンスクラバーとも称される）などにも適用可能である。

【００３８】

【発明の効果】以上の説明から明らかなように、請求項１に記載の発明によれば、外容器の内部のミスト、臭気およびパーティクルは、カップ内排気口またはカップ外排気口を介して全て排気されるので、装置内部でのそれらの循環を防止することができるとともに、それらが外容器外に漏洩しないようにすることができる。したがって、装置外部に臭気が漏れることに起因する安全衛生上の問題を回避することができるとともに、装置内部での基板汚染や装置外部の基板汚染を防止することができる。

【００３９】また、請求項２に記載の発明によれば、排気流量調整手段を介してカップ外排気口の排気流量を調整することにより、カップ内のミストなどを吸い出すことなく、外容器内にミストなどが滞留することなく、カップ内から漏れ出たミスト等を確実に排気することができる排気流量に調節することができる。したがって、処理内容に応じて排気流量を最適な排気流量に調節することができる。

【図面の簡単な説明】

【図１】実施例に係る回転式基板塗布装置の要部を示す縦断面図である。

【図２】動作の一例を示すタイムチャートである。

【図３】動作の説明に供する図である。

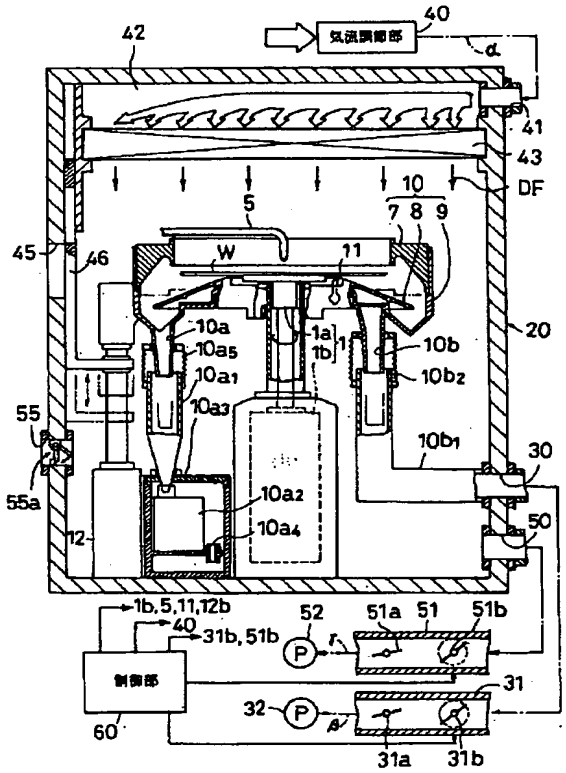
【図４】動作の説明に供する図である。

【図５】従来例に係る回転式基板塗布装置の要部を示す縦断面図である。

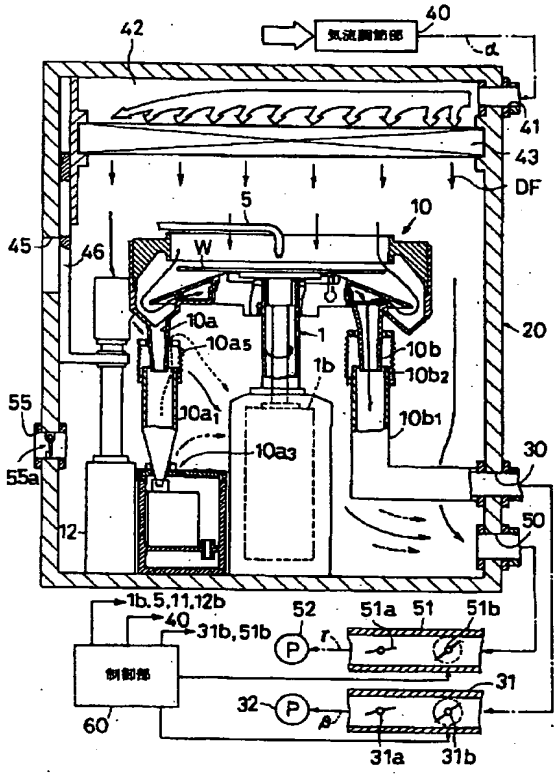
【符号の説明】

１　…　回転駆動部（回転駆動手段）
１ａ　…　スピンチャック
１ｂ　…　電動モータ
５　…　処理液供給ノズル（処理液供給手段）
１０　…　飛散防止カップ
１０ａ　…　排液口
１０ｂ　…　排気口
１１　…　バックリンスノズル（処理液供給手段）
２０　…　外容器
３０　…　カップ内排気口
５０　…　カップ外排気口
５１ｂ　…　自動ダンパー（排気流量調整手段）
ＤＦ　…　ダウンフロー
α　…　ダウンフローの流量
β　…　カップ内排気流量
γ　…　カップ外排気流量

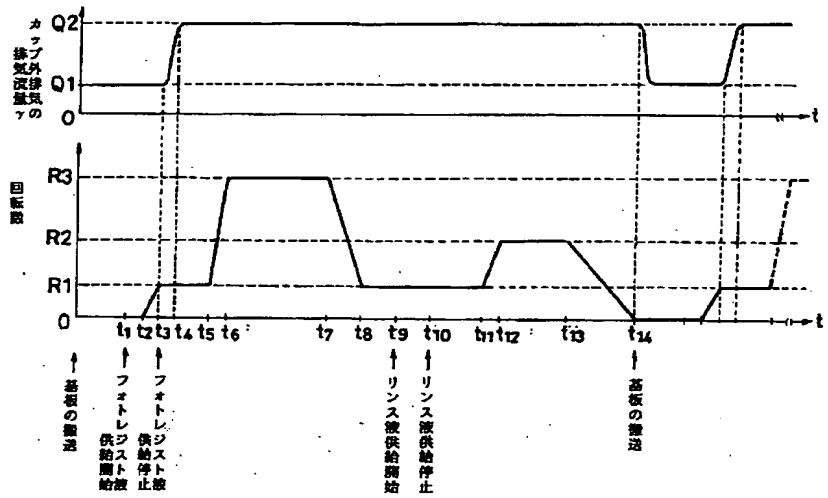
【図１】


気流調節部
40
42
41
43
DF
5
10
7 8 9
45
46
W
11
20
10a
10a5
10a1
10a3
1a
1b
10b
10b2
10b1
55
55a
30
10a2
10a4
12
50
1b,5,11,12b
40
31b,51b
52
51a
51
51b
制御部
60
31
32
31a
31b

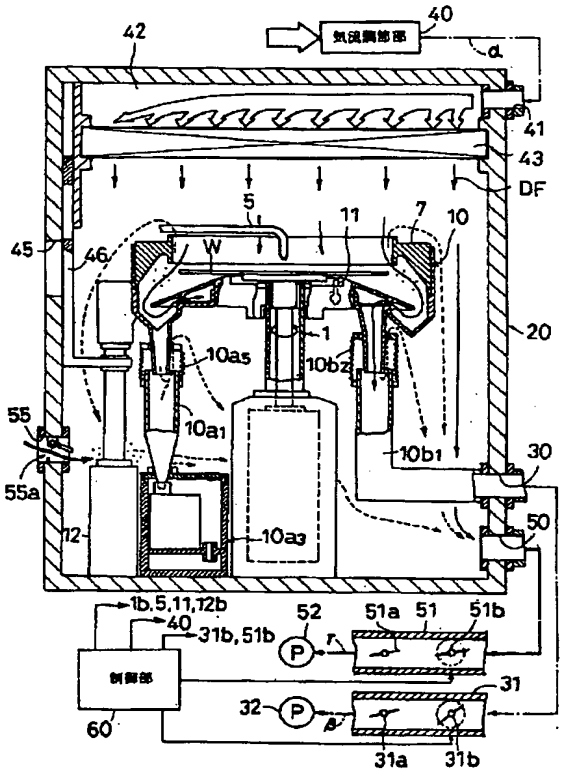
【図３】


気流調節部
40
42
41
43
DF
5
10
45
46
W
20
10a
10a5
1
1b
10b
10b2
10b1
10a1
10a3
55
55a
30
12
50
1b,5,11,12b
40
31b,51b
52
51a
51
51b
制御部
60
31
32
31a
31b

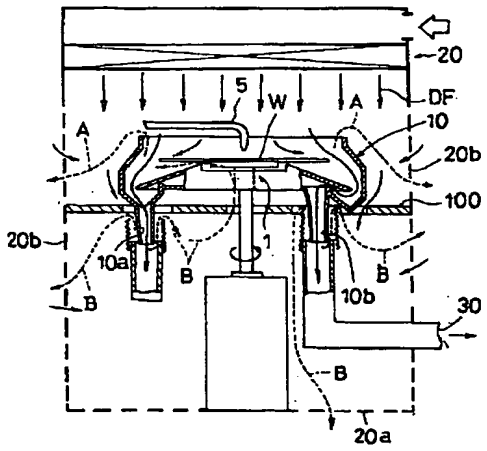
【図２】


カップ外排気流量
Q2
Q1
0
t
回転数
R3
R2
R1
0
t1 t2 t3 t4 t5 t6 t7 t8 t9 t10 t11 t12 t13 t14
基板の搬送
フォトレジスト液供給開始
フォトレジスト液供給停止
リンス液供給開始
リンス液供給停止
基板の搬送

【図４】


気流調節部
40
42
41
43
DF
5
11
7
10
45
46
W
1
20
10as
10bz
10a1
10b1
55
55a
30
12
10a3
50
1b,5,11,12b
40
31b,51b
52
51a
51
51b
制御部
60
31
32
31a
31b

【図５】


20
5
W
A
DF
10
20b
100
A
20b
10a
B
1
B
B
10b
30
B
20a